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Review Article

Functional Medicine in Practice: What is Functional Medicine and How to Integrate Functional Medicine into Medical Practice

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Abstract

Functional medicine (FM) at its incipience proposed that patient symptoms should be separated and explicitly approached for more effective treatment results. This theory was in contrast to the accepted medical practice of the 1970s and 1980s in the US and elsewhere. FM's premise resulted in functional evaluations at the organ, tissue, and cellular levels. Such evaluations are accomplished by examining radiographic and physiological biomarkers, radioimmune assay, computed tomography, nuclear imaging, and other non-invasive diagnostic methods.

This fundamental rationale of FM was lent credence by the US Congress in 1994 by the de facto acceptance through the regulation of dietary supplements (which were used in dietary and nutritional-supplemented treatment programs). These guidelines highlighted more widespread awareness of the growing trend in nutritional application and advanced acceptance and recognition of FM practitioners.

Nonetheless, the beginnings of FM could be considered as far back to Hippocrates, the father of Western medicine. Hippocrates practiced an individualized and conservative treatment approach. Hippocrates advocated prevention over symptomatic treatment, and deemed a natural and balanced diet a cornerstone of health and well-being.

FM has advanced in acceptance and recognition, notwithstanding its relative shortage of evidence-based research during its earliest period. Also, FM has been criticized for not having a precise and universally applied definition or general medical acceptance.

FM practitioners believe that their methods help identify specific conditions or diseases earier than established medical protocols. FM relies on evaluating such markers as C-reactive protein, glucose intolerance, vitamin D3, and thermography tests to detect abberations at an early stage. Also, FM practitioners rely on their test results for providing personalized treatment programs for their patients.

Specific conditions have been reported, at times, to benefit from functional medicine or a combination of standard medical treatment and functional medicine, such as arthritis, celiac disease, depression, fatigue, heartburn, bloating, diarrhea, arthralgias and myalgias, hyperlipidemia, gout, and type 2 diabetes mellitus. Also, FM, when combined with medically recognized cancer treatment, has demonstrated some success in a limited number of specific cancer cases.

In several studies, FM treatments appeared to have minimal to no adverse effect affects if appropriately applied under the trained supervision of a licensed and certified health care provider. To date, there are no recognized contraindications for FM. However, FM has distinct limitations, such as typically comprising prolonged treatment programs and stringent protocols. FM patients may be unable to adhere to dietary constraints and sustain a balanced life, which are crucial determinants in FM.

FM practitioners and treatments have received strong opposition from particular medical groups, claiming that the FM approach can be harmful and dangerous. However, based on a relatively small number of research studies and sample sizes, FM may alone manage specific conditions or do so in conjunction with verified medical treatments for enhanced patient outcomes.

Functional medicine certification programs are offered to licensed healthcare professionals, such as medical doctors, osteopaths, dentists, nurses, pharmacists, or naturopathic practitioners. Also, more in-depth specialization programs are available.

Keywords: *Alternative; Complementary; Diabetes; Diet; Obesity; Stress; Systems Biology*

Abbreviations

AAFP: American Association of Family Physicians; CME: Continuing Medical Education; CVD: Cardiovascular Disease; FM: Functional Medicine; FMT: Fecal Microbiota Transplant; GMH: Global Mental Health; GPH: Global Physical Health; PROMIS: Patient-Reported Outcome Measurement Information System; RCT: Randomized Control Trial

Introduction

Biomedical researchers are continually exploring new techniques and technologies to enhance the therapeutic efficiency of available drugs or add to existing diagnostic tools. Currently, the trend has been shifting toward the use of alternative medicine. A probable reason for this change is the need for prevention or early detection of a condition, reducing treatment-related costs. However, whether the impact of alternative medicine is genuine or backed by solid scientific evidence remains unsettled.

Mainstream medicine practitioners consider alternative or integrative medicine as pseudoscience or myth. Literature is replete with publications by "messengers of medicine" disproving an alternative mode of therapy. On the contrary, many well-established physicians have successfully blended common medical practice with alternative medicine.

Functional medicine (FM) is not a progeny of recent times but has been referred to in the medical literature since the 1980s. FM was previously termed functional somatic syndromes [1], referring to a cluster of syndromes rather than a specific disease with a histopathology-based diagnosis [2]. Dr. Jeffrey Bland, a Ph.D. in chemistry, is widely considered the originator of modern day FM.

Hippocrates, the father of Western medicine, may have ascribed to the application of FM principles. Hippocrates supported a flexible treatment approach without extreme measures—and advocated holistic care rather than merely addressing symptoms and accepted the importance of a healthy diet, quoting, "Let food be thy medicine and medicine be thy food" [3–5].

FM has made its mark despite conflicting opinions and lack of a precise definition [6]. FM follows a more natural healing mode to address the origin of a disease and not just manage a disease's symptoms. In addition to Dr. Bland, Frank Lipman and Mark Hyman contributed to the establishment of FM. Lipman and Hyman practiced a system of healthcare that merged traditional and Western medicine—using antibiotics and more natural healing approaches, such as acupuncture, FM, biofeedback, Chinese medicine, and yoga. Lipman and Hyman first evaluated the basic needs of a patient and tailored a treatment plan based on the assessment results [7].

This review presents a background and overview of FM, supportive evidence, current status and recognition, conditions purported to be treated or pervented by FM, FM's limitations, training as an FM practitioner, and FM's potential future application and integration into mainstream medicine.

Discussion

The beginnings of FM

In 1988, HealthComm ventured into nutritional medicine development. In association with several health care experts, Jeffrey and Susan Bland, discussed the concept in British Columbia (Canada). At that time, "systems biology" was an upcoming concept that considered biology and molecular medicine, giving rise to FM. Importantly, FM was already being used in geriatric and psychosomatic illnesses. The final accord was that the term "functional medicine" should honor the molecular medicine view of Linus Pauling [8].

The concept of and rationale for FM

Bland (2017) conducted a literature search, which revealed that psychosomatic illnesses were considered under the charge of psychiatry and that therapeutic intervention for these conditions aimed at behavioral and cognitive well-being [9]. In the early 1990s, researchers stated that a collective appraisal of symptoms is inappropriate and that each symptom must be separated for practical diagnosis and management [9–11]. Several studies were published in the following decade, supporing this assumption. The studies by Lacourt [12] and Williams [13] appended the evidence, stressing the need to cease the grouping of symptoms and provide a personalized treatment plan.

Thus, the call for functional assessments at the organ, tissue, and cellular levels resulted in the use of radiographic and physiological biomarkers, radioimmune assay, computed tomography, nuclear imaging, and other non-invasive diagnostic methods.

The influence of lifestyle-related factors in causing diseases is well recognized in the medical field. For example, the complex mechanism of diabetes mellitus, its association with obesity, stress, and diet have been documented extensively. Thus, the practice of "personalized lifestyle medicine" targets the individual patient's requirements and crafts a therapeutic plan based on nutritional needs, metabolism, and lifestyle changes [14]. FM also works on this principle and considers the primary patient requirements while ascertaining a therapeutic plan, and attempts to isolate the cause or origin in a disease.

Another relevant aspect is understanding the differences between integrative medicine and FM. Detoxification therapies, medication reduction therapy, nutritional therapy, and regenerative medicine are examples of integrative medicine. These approaches aim at correcting the bodily disease holistically, and curing the mind and soul. On the contrary, FM favors up an individualized approach from diagnosis to management. FM considers natural supplements and conventional medicine. Lifestyle modifications constitute an essential aspect of treatment. Acupuncture, naturopathy, massage, osteopathy, and yoga can be applied as modalities of FM [15].

Recognition of FM

In 1994, a new act—regulating dietary supplement claims—was introduced in the United States. This decision of the US Congress was based on the understanding and acceptance of the FM concept and principles. The act recommended that manufacturers highlight the exact role of nutrients in the human body regarding their respective products, giving rise to catchphrases, such as "calcium builds strong bones" and "fiber maintains bowel regularity" [9].

The Institute for Functional Medicine (IFM), founded in 1991, suggests that the "clinical model" of therapy is outdated. Despite advances in medicine and surgery, it remains challenging to manage or prevent specific ailments. An approach to cure the precise origin of the disease would be more effective. This strategy is similar to the "omics revolution", considering the harmful environment and lifestyle associated with disease and not solely due to genetic make-up [16]. The IFM follows a particular construct based on the core principles of FM: assessing the biochemical individuality, providing a patient-centered treatment approach, seeking a dynamic balance among the mind, body, and spirit, addressing physiological factors, encouraging strategies to enhance physiological vitality, promoting organ reserve, and considering that FM is a science-based approach. Another recognized name in the field, Cleveland Clinic Center for Functional Medicine, was established in 2014. The center's foundational purpose is following a therapeutic approach, comprising the triad of nutrition, lifestyle, and behavioral modifications [17].

Evidence in support of FM

Randomized control trials (RCTs) are considered a high level of evidence in the medical literature. However, limitations of RCTs include the presence of confounding factors and fewer analytical variables. It is challenging to plan and conduct a study based on individualized

treatment. Moreover, research consisting of nutrition as the primary research question has a different set of limitations. For example, the constituent of a particular food is not one but a group of nutrients, and it is challenging to remove variation in dietary intake. Also, varying genetic structures, metabolisms, and environmental factors affect the research outcome [18,19]. Thus, the literature lacks studies on functional or personalized lifestyle medicine.

A retrospective cohort study at the Cleveland Clinic Center for Functional Medicine presented evidence supporting the efficacy of the therapeutic approach. The health-related quality of life was measured by the Patient-Reported Outcome Measurement Information System (PROMIS), Global Physical Health (GPH), and Global Mental Health (GMH) scores at 6 and 12 months. Patients receiving the FM model of care demonstrated improved scores that sustained up to 1 year [20].

A 2012 case report—discussing a refractory illness of a 72-year-old male patient—contributed to the evidence. The patient had many symptoms, including depression, fatigue, heartburn, bloating, diarrhea, arthralgias, and myalgias. Brief Fatigue Inventory, Brief Pain Inventory, and Patient Health Questionnaire were used to assess the patient [9]. The therapeutic plan consisting of medicines and supplements was individualized based on the laboratory findings. The patient was prescribed fluconazole, probiotics, amino acids (lysine and glycine), vitamin supplements, and coenzymes. At the end of one year, the patient reported a steady improvement, including apparent physical and psychological well-being [21].

In 2018, a report discussing the case of a 71-year-old man with a 25-year history of chronic cough was published. The patient had comorbidities of hyperlipidemia, gout, and type 2 diabetes mellitus. The patient was prescribed a medicine and nutraceutical supplementation regimen and followed up for > 2 years. The patient outcome was encouraging, with improvements in lipid profile and glycemic status, and to the complete cure of the troublesome cough [22].

In their systematic review of RCTs, Kennedy., *et al*. (2007) concluded that natural health products reduce costs during the postoperative period. Nine RCTs on postoperative complications, CVD, gastrointestinal disorders, critically ill patients, and urinary tract infections were reviewed in the study [23].

Taxman., *et al*. (2016) published a report of an 80-year-old woman diagnosed with metastatic invasive ductal breast carcinoma. The therapy was aimed at decreasing the disease burden and chemotherapy-related side effects. The regimen prescribed was a combination of medications, diet supplements, exercise, and sleep programs, along with support recommendations. At the 3-year follow-up, the patient had favorably responded to the therapy (FM and chemotherapy) with no recurrence [24].

In specific cases, FM appears to detect disease earlier than conventional medicine. C-reactive protein, glucose intolerance, vitamin D3, and thermography tests distinguish irregularities early and help reverse the condition before severe damage occurs. FM practitioners depend on these test results for tailoring an individualized treatment regimen [25].

Training of health professionals to be FM practitioners

The IFM offers certification programs to licensed health care professionals. A certified health coach certificate is awarded after a year-long course. The institute also offers more intensive specialty courses [26]. Individuals with a professional degree in medicine, dentistry, nursing, pharmacy, or naturopathy are eligible for the course. In 2006, Dr. Daniel Kalish started the Kalish Institute of Functional Medicine that offers online training programs—collaborating with the IFM to launch online training called "My Practice Plan" [27].

There is a demand for legal support to practice FM. There is no legal defense for FM, possibly due to the medical profession's lack of complete acceptance of this field. A professional's own experience and knowledge should be applied in a particular condition.

If the application of FM alone does not ameliorate a condition, FM can be augmented with mainstream medical treatment and vice versa. A licensed FM practitioner can follow the Model Guidelines for the Use of Complementary and Alternative Therapies in Medical Practice and the Federation of State Medical Boards' guidelines [28]. Practitioners must maintain a complete medical record of the patients receiving therapy and ensure favorable outcomes from the individualized regimen.

Conditions that purportedly benefit from the application of FM

FM considers that dysregulation of tight junctions, or intestinal permeability, is associated with autoimmune diseases [29]. Antigenic food particles, toxic agents, microorganisms and their byproducts crossing the gut lumen, induce untoward immune responses. Thus, it is crucial to restore equilibrium in the gut microbiota to alleviate the autoimmune condition through diet modification or fecal microbiota transplant (FMT). In FMT, the fecal microbiota from a healthy donor is transferred to a diseased or compromised recipient [29–31].

FM seems beneficial for depression. The association between diet, lifestyle, gut microbiota, and cognitive conditions (such as depression, anxiety, and Parkinsonism) is unclear. In addition to medicinal therapy, lifestyle modifications have a positive impact on such mental conditions. In a study, "forest bathing" considerably lowered depression and anxiety in the participants [32]. The benefits of having an active and happy social life, exercising, playing, and meditation are harnessed in functional therapy [33–35].

In endocrine conditions, such as type 2 diabetes mellitus, the role of a regulated diet is acknowledged [36]. The type and quantity of carbohydrates, fats, gluten, proteins, and vitamins help maintain blood glucose levels [35]. Hence, the treatment regimen in the functional model of care is inclusive of these factors.

Dietary interventions form a highly significant part of cardiovascular disease (CVD) prevention and management. Omega-3 fatty acids, vitamin B-12, spirulina, and the Mediterranean Diet help the body oppose these conditions [36–39]. It is beneficial to avoid Western food habits, meat, sugar, and processed foods. FM supports these modifiable features of the human diet and encourages an individual to sleep adequately and exercise moderately. An FM practitioner focuses on these areas while strategizing a CVD treatment plan.

As an adjunct to conventional care, FM helps manage arthritis. Data from a large retrospective study revealed a significant reduction in pain and the PROMIS physical health score among patients with rheumatoid and psoriatic arthritis. The FM approach focused on improving nutrition and digestive function by avoiding processed foods, sugar, gluten, and dairy products. Patients were advised to consume omega-3 fats, fibers, and phytonutrients. Assessments were performed based on laboratory findings of vitamin D or omega 3 fatty acids. Also, individual appraisals were performed to tailor a suitable regimen [40].

FM can cure or prevent celiac diseases by the application of a gluten-free diet. The roles of probiotics and gluten-degrading enzymes are being researched to reduce the limitations of strictly maintaining a completely gluten-free diet [41–43] and to benefit patients with chronic allergies. The correct allergen must be identified to know an individual's predilection for hypersensitivity. The therapy targets susceptible factors and recommends lifestyle interventions to cure allergies [44].

Limitations of FM

There is no documented evidence regarding any specific disadvantages or contraindications of FM. However, limitations of FM include long treatment times, stringent protocols, and non-application in emergencies. Individuals receiving FM therapy may find it challenging to monitor and maintain strict dietary recommendations and a balanced routine in daily life. FM alone may not be adequate to manage a specific ailment. However, FM can be combined with conventional medicine for achieving more favorable patient outcomes.

It is essential to produce relevant evidence to endorse or refute the claims of FM practitioners. If sound data cannot be produced, anecdotal evidence must be recorded and published as a foundation and motivation for further research studies.

The acceptance of FM has been measured to date. The American Association of Family Physicians (AAFP) indicated that some FM treatments are harmful and dangerous. In 2014, the AAFP placed a moratorium on the continuing medical education (CME) credits for FM programs. Later, the moratorium was partially lifted and allowed educating interested patients but retained the halt on "how to" teaching courses [45,46].

Conclusion

The origins of FM could be correlated to Hippocrates, the father of Western medicine, who advised a personalized, conservative, and balanced treatment approach. Hippocrates advocated preventive care rather than treating symptoms and promoted a wholesome diet as being fundamental to sound health.

FM has persisted and promulgated despite its shortcomings and critics, and has been compromised by lacking a precise and accepted definition. As with Hippocrates, FM aims at addressing the root cause of a disease, not treating only the symptoms.

A rationale for FM arose in contrast to that of established medical practice, particularly in psychiatry, of collective appraisal of symptoms. FM proposed that symptoms should be separated and individually addressed for more effective treatment outcomes. This concept resulted in functional assessments at the organ, tissue, and cellular levels by considering radiographic and physiological biomarkers, radioimmune assay, computed tomography, nuclear imaging, and other non-invasive diagnostic methods.

This basis was obliquely supported by the US Congress (in the regulation of dietary supplements), providing an acceptance of such a dietary and supplement-based approach and a de facto recognition of FM practitioners.

Some conditions reported to benefit from functional medicine or a combination of conventional medical treatment and functional medicine include arthritis, celiac disease, depression, fatigue, heartburn, bloating, diarrhea, arthralgias and myalgias, hyperlipidemia, gout, and type 2 diabetes mellitus. Also, FM has been applied with some success in a limited number of cancer cases when combined with accepted medical treatments.

In some instances, FM may identify specific conditions or diseases earlier than established medicine. C-reactive protein, glucose intolerance, vitamin D3, and thermography tests can detect aberrations at an early stage and, thus, help reverse a condition before severe damage occurs. FM practitioners depend on these test results for personalizing an individualized treatment program.

Certification programs in FM are available to licensed health care professionals, such as medical doctors, osteopaths, dentists, nurses, pharmacists, or naturopathic practitioners. Also, more in-depth specialty training programs are available.

To date, there are no general contraindications for FM, seeming to have a minimal probability of causing harm if appropriately applied under the trained supervision of a licensed and certified health care provider. However, FM has specific limitations of extended treatment programs and stringent protocols. Also, FM patients may be unable to adhere to dietary restrictions and maintaining a balanced lifestyle.

Some medical groups have charged that FM treatments are harmful and dangerous. However, albeit based on limited research studies and sample sizes, FM alone may control specific conditions or when combined with recognized medicinal treatment for enhanced patient outcomes.

Conflict of Interest Statement

The authors declare that this paper was written in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

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