Dietary Approaches to Reducing MS Related Symptoms

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Dr. Terry Wahls LLC

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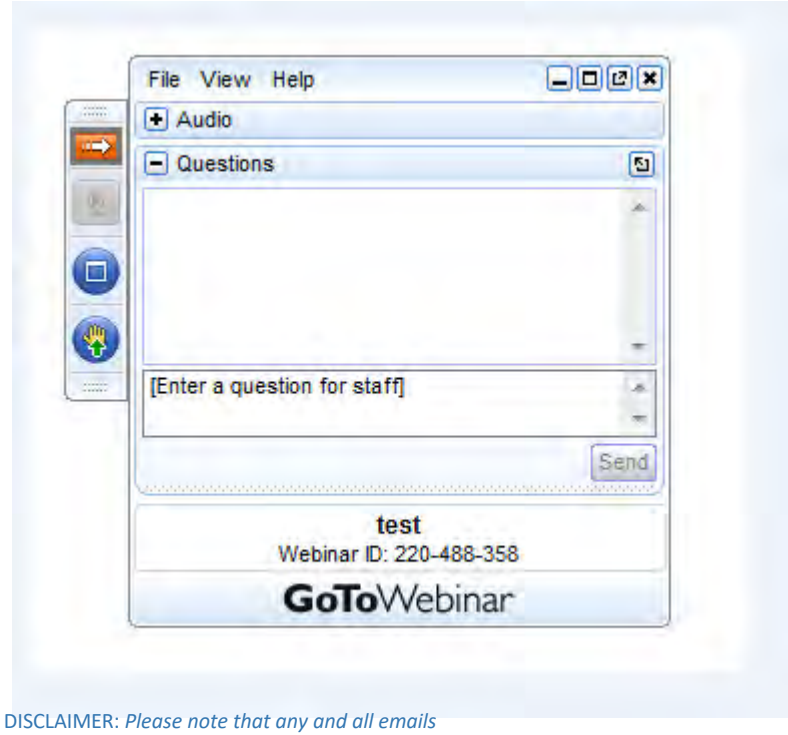
Technical Issues & Clinical Questions

- Please type any technical issue or clinical question into either the “Chat” or “Questions” boxes, making sure to send them to “Organizer” at any time during the webinar.

- We will be compiling your clinical questions and answering as many as we can the final 15 minutes of the webinar.



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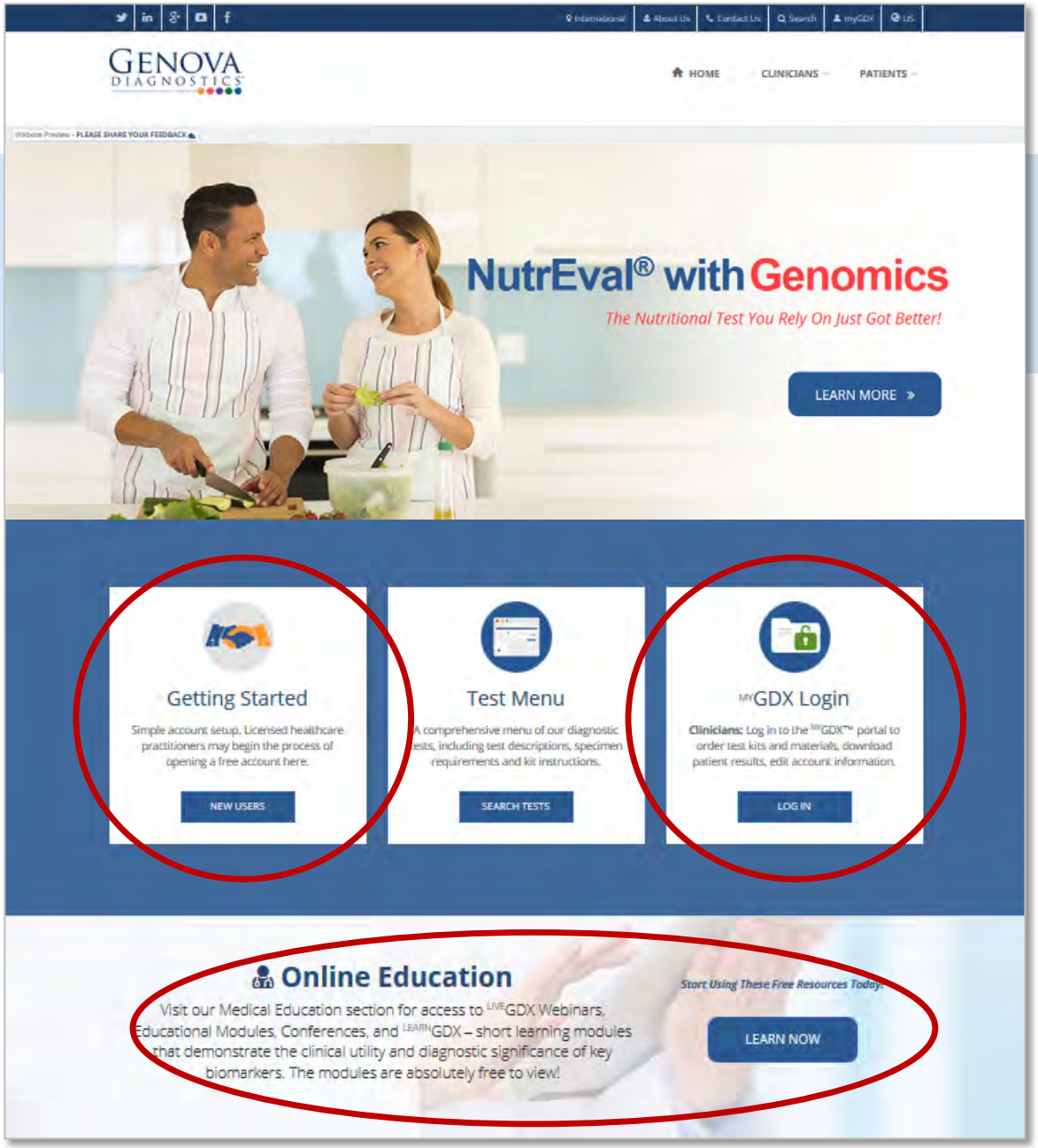

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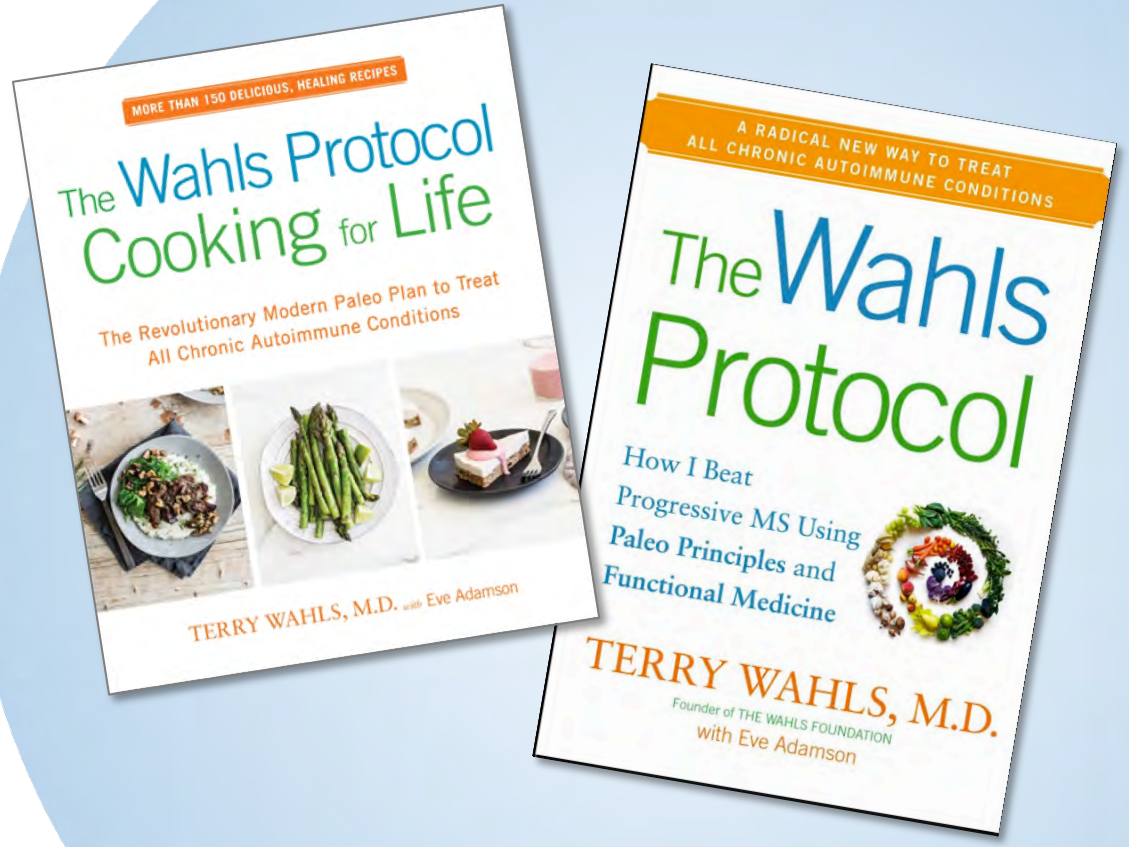
Disclosures

- Grant Funding
  - National MS Society
- Trademarks
  - Wahls™ Diet Plans, Wahls Protocol®
- Financial relationships with
  - PenguinRandomHouse Inc.; Integrative Medicine for Mental Health; Institute for Health and Healing; Suttler Pacific; BioCeuticals; NCURA; MCG Health LLC; Genova Diagnostics
- Equity interest
  - Dr. Terry Wahls LLC
  - The Wahls Institute PLC
  - www.terrywahls.com

- Books



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Dietary Approaches to Reducing MS Related Symptoms

- Tell my story
- Review the science behind my protocol
- Review our research
- Review implications for other disease states

Objectives: By the End of Talk You Will Be Able To…

- Name at least one mechanism by which dietary factors may contribute to neuroinflammation and neurodegenerative disease processes and potential worsening of MS related symptoms
- Name at least at least three specific food groups that can help stabilize and or reverse neuroinflammation and neurodegenerative disease processes and MS related symptoms
- Identify an effective and inexpensive test that clinicians and patient can use to monitor the microbiome
- Identify testing to guide supplement recommendations for MS patients

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In 2000, I Became a Patient

- Left leg weakness
- Prior history visual dimming
- Lesions in spinal cord
- Abnormal CSF
- Diagnosis relapsing-remitting MS

Cost of MS to Society/Individual

- RRMS annual cost of disease modifying drugs
  - $45,000 to $72,000/ year
  - Mean cost (Poland $41,400)
- + Annual MRI, labs, therapy, office visits
- Within 10 years of diagnosis
  - 50% exit work force due to fatigue disability
  - 30% gait disability
  - Most convert to SPMS
- SPMS – chemotherapy, progressive disability
- PPMS – no approved treatments

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Kolasa K, et. al. Przegl Epidemiol. 2013;67(1):75-9, 157-60.

Cost of MS to Society/Individual

- Lost of income from person with MS
- Leading cause of early disability
- Caregiving cost from strangers
- Family caregiver lost income
- Early and lengthy NH care
- Leading diagnosis for those requesting assisted suicide from Dr. Kevorkian

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Naci H, et. al. Pharmacoeconomics. 2010;28(5):363-79.

The Cleveland Clinic

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7 Years of Decline
NARCOMS QOL Survey

	11/23/05	6/2/06	11/28/06	5/5/07
MS Sx Overall	Worse	Worse	Worse	Worse
Fatigue	Mod	Severe	Total	Total

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Timeline

- 1980 Face pain
- 1987 Dim vision
- 2000 Leg weakness (Copaxone)
- 2002 Paleo Diet prior vegetarian
- 2003 Progressive MS (Novantrone)
- 2004 Added various vitamins (Tysabri)
- 2005 (Cellcept)
- 2007 Discovered E-stim and IFM
- 2008 Reorganized / structured Paleo Diet

12 Months of Structured Paleo Diet, Exercise, NMES, & Meditation

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CASES JOURNAL

Open Access

Case report

Neuromuscular electrical stimulation and dietary interventions to reduce oxidative stress in a secondary progressive multiple sclerosis patient leads to marked gains in function: a case report

David Reese[1,2], ET Shivapour[3], Terry L Wahls[4,5,6*], Shauna D Dudley-Javoroski[2] and Richard Shields[2]

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* Corresponding author

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Cases Journal 2009, 2:7601 doi: 10.4076/1757-1626-2-7601

This article is available from: http://casesjournal.com/casesjournal/article/view/7601

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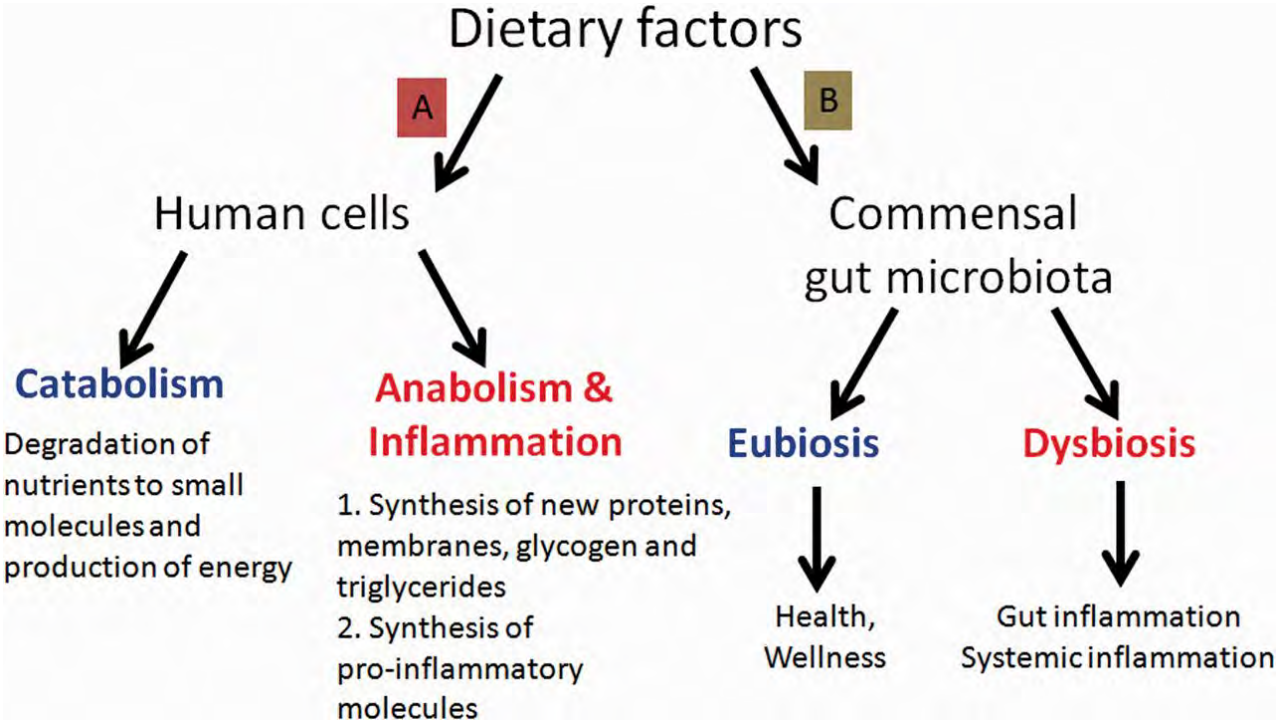
Reese D, Wahls TL, et.al. *Cases Journal*. 2009 Dec;2(1):7601.

Neuroprotection vs. NeuroRegeneration

- Restoring function is the goal
- Restore the brain / mitochondria

Figure 1. The two routes by which diet can influence our health: (A) the metabolism of our cells and (B) the population of our gut microbiota.



ASN NEURO

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Paolo R, et. al. *Neuro* 2015;7:1759091414568185.

Dairy & MS
Casein, Gluten & Schizophrenia

- Liquid cow milk (not cheese) and MS prevalence was highly correlated (rho = 0.836) across 27 countries and 29 populations

- IgG to casein and gluten were significantly ↑
  in recent onset and non-recent onset schizophrenia compared to controls (p≤0.00001-0.004)

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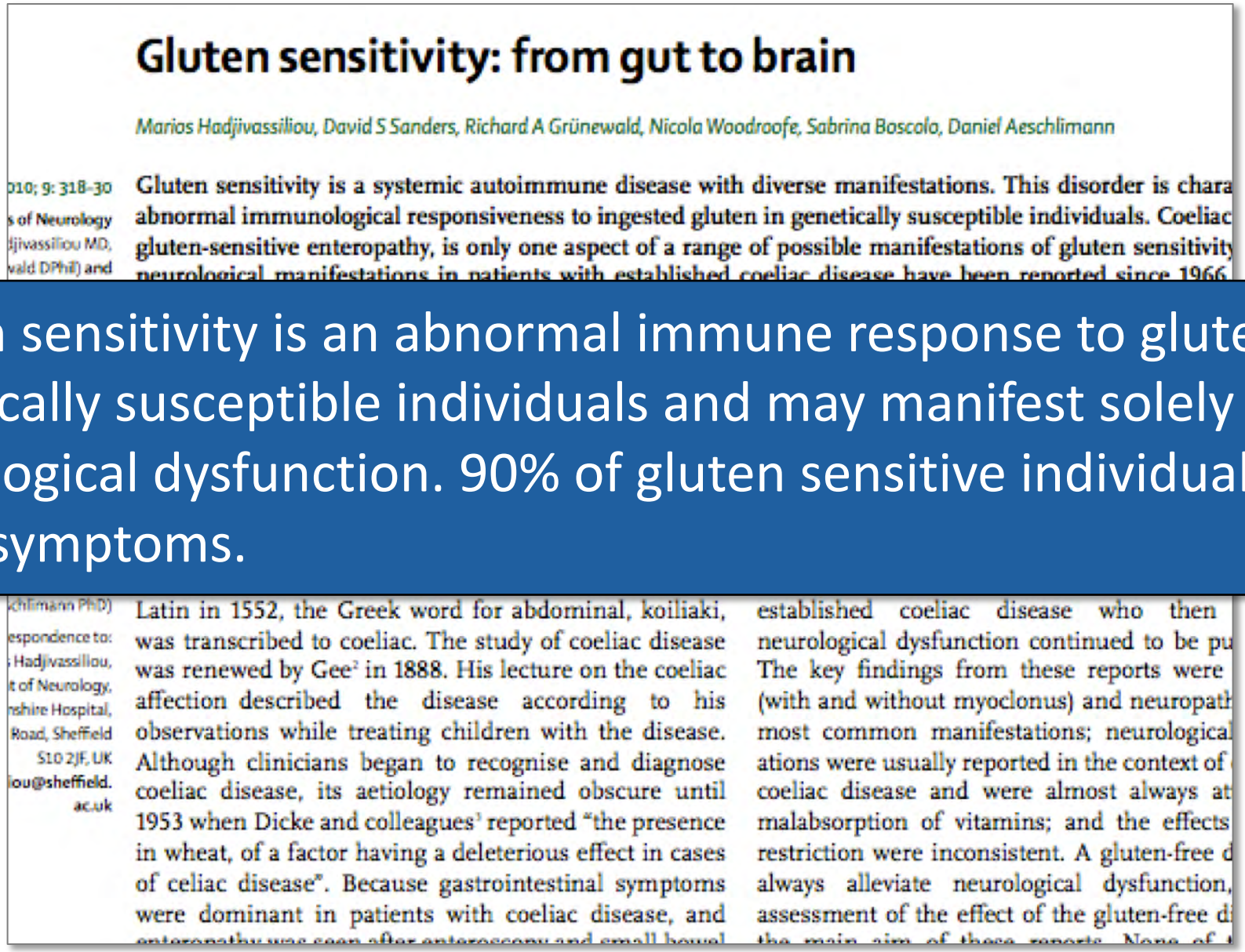
2. Severance E, et. al. Schizophr Res. 2012 Jun;138(1):48-53.



Gluten sensitivity: from gut to brain

Marios Hadjivassiliou, David S Sanders, Richard A Grünewald, Nicola Woodroofe, Sabrina Boscolo, Daniel Aeschlimann

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Gluten sensitivity is a systemic autoimmune disease with diverse manifestations. This disorder is chara abnormal immunological responsiveness to ingested gluten in genetically susceptible individuals. Coeliac gluten-sensitive enteropathy, is only one aspect of a range of possible manifestations of gluten sensitivity neurological manifestations in patients with established coeliac disease have been reported since 1966

Latin in 1552, the Greek word for abdominal, koiliaki, was transcribed to coeliac. The study of coeliac disease was renewed by Gee[2] in 1888. His lecture on the coeliac affection described the disease according to his observations while treating children with the disease. Although clinicians began to recognise and diagnose coeliac disease, its aetiology remained obscure until 1953 when Dicke and colleagues[3] reported "the presence in wheat, of a factor having a deleterious effect in cases of celiac disease". Because gastrointestinal symptoms were dominant in patients with coeliac disease, and

established coeliac disease who then neurological dysfunction continued to be pu The key findings from these reports were (with and without myoclonus) and neuropath most common manifestations; neurological ations were usually reported in the context of coeliac disease and were almost always at malabsorption of vitamins; and the effects restriction were inconsistent. A gluten-free d always alleviate neurological dysfunction, assessment of the effect of the gluten-free di

Gluten sensitivity is an abnormal immune response to gluten in genetically susceptible individuals and may manifest solely with neurological dysfunction. 90% of gluten sensitive individuals have no GI symptoms.

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Hadjivassiliou M, et. al. *Lancet Neurol. 2010* (9) no. 3: 318-330.

Gluten Sensitivity: From Gut to Brain

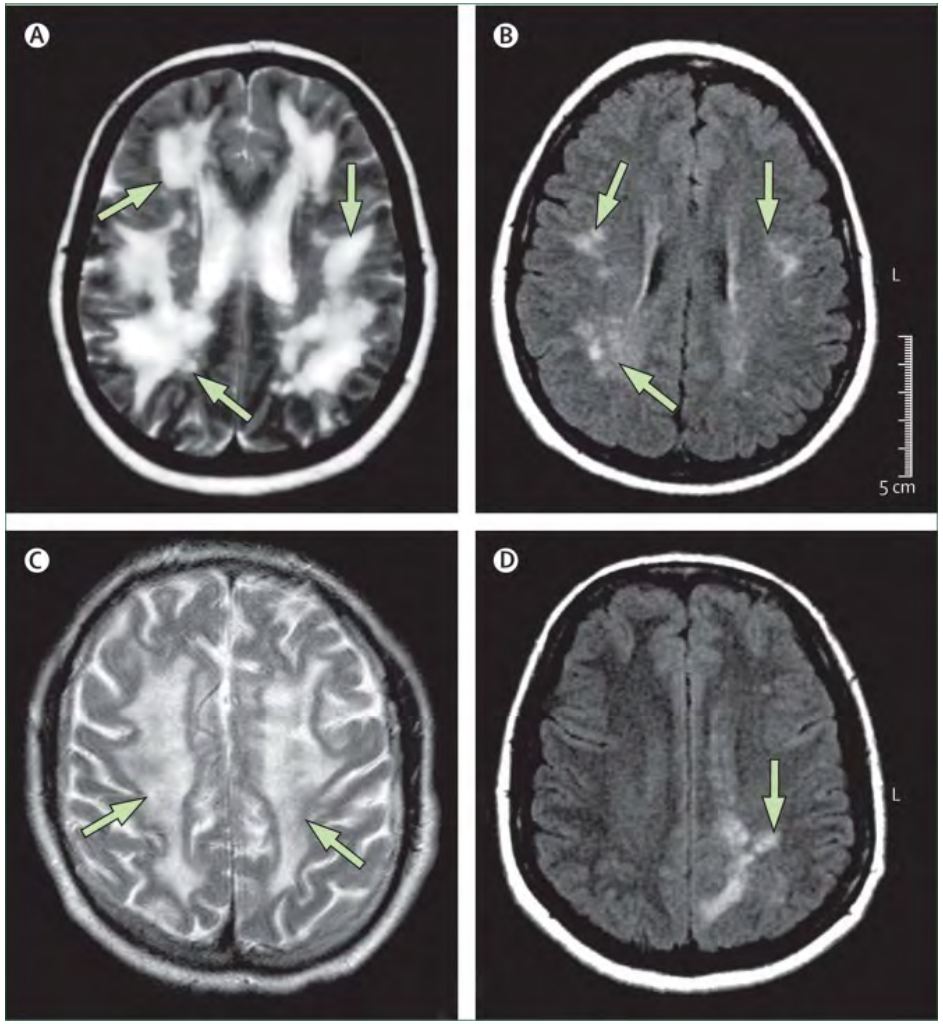

Figure 2. MRI in four patients with gluten encephalopathy. The extent and variability of white matter abnormalities caused by gluten sensitivity can be seen in these four patients (A–D). A and C show diffuse white matter changes, whereas B and D show more f...

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Hadjivassiliou M, et. al. Lancet Neurol. 2010 (9) no. 3: 318-330.
http://dx.doi.org/10.1016/S1474-4422(09)70290-X

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- Celiac disease with neurologic manifestations in children. Rev Med Chir Soc Med Nat Iasi. 2013 Jan-Mar;117(1):88-94.
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Myelin

36 Key Micronutrients

Bourre JM. Effects of nutrients (in food) on the structure and function of the nervous system: update on dietary requirements for brain. Part 1: micronutrients. Part 2 Macronutriients
J Nutr Health Aging 2006;10(5):377-85.

Bowman, G. et al. Nutrient biomarker patterns, cognitive function, and MRI measures of brain aging.
Neurology. 2012 Jan 24;78(4):241-9.

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Nutrients		
Vitamin A, retinol	Alpha carotene	Carnitine
Vitamin B_1 (thiamine)	Beta carotene	Lipoic acid
Vitamin B_2 (riboflavin)	Beta cryptoxanthin	Creatine
Vitamin B_3 (niacin)	Lutein	Cholesterol
Vitamin B_5 (pantothenic acid)	Lycopene	Alpha-linolenic fatty acid (ALA)
Vitamin B_6 (pyridoxine)	Zeaxanthin	Eicosapentaenoic acid (EPA)
Vitamin B_9 (folic acid)	Iron	Docosahexaenoic acid (DHA)
Vitamin B_{12} (cobalamin)	Copper	Arachidonic acid (AA)
Vitamin C	Zinc	Gamma-linolenic faty acid (GLA)
Vitamin D	Iodine	Linoleic acid (LA)
Vitamin E	Magnesium	N-Acetylcysteine
Vitamin K	Selenium	Taurine

Sulfur-Rich Foods

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Why Brassica and Allium?

- Improve detoxification
- Increase glutathione production
- Increase GABA production
- Enhance neuroprotection
- Improve endothelial function

Brassica and Allium References

- Neuroprotective Effect of Brassica oleracea Sprouts Crude Juice in a Cellular Model of Alzheimer's Disease. Med Cell Longev.2015;2015:781938
- Learning and memory promoting effects of crude garlic extract. Indian J Exp Biol.2013 Dec;51(12):1094-100.
- Enhancement of the neuroprotective activity of Hericium erinaceus mycelium co-cultivated with Allium sativum extract. Arch Physiol Biochem.2015 Feb;121(1):19-25.

Why Emphasize Mushrooms?

- Increase nerve growth factors (NGF)
- *Hericium erinaceus* (Yamabushitake or **Lion's Mane**) stimulate the production of NGF (in vitro)
- Activate natural killer cells
- Prime innate and adaptive immunity

Mori K, et. al. *Biol Pharm Bull*. 2008 Sep;31(9):1727-32.
Lee DH, et. al. *Int J Med Mushrooms*. 2014;16(1):1-16.
Akramiene D, et. al. *Medicina (Kaunas)*. 2007;43(8):597-606.
Lai PL, et. al. *Malaysia Int J Med Mushrooms*. 2013;15(6):539-54.
Phan CW, et. al. *Crit Rev Biotechnol*. 2015;35(3):355-68.

Leafy Greens

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Why Greens?

- Vitamin K1 metabolized to K2-MK7 in gut
- K2 important in:
  - Myelin production
  - Calcium influx into bones and teeth
- Carotenoids
- Magnesium

Greens References

- Age- and brain region-specific effects of dietary vitamin K on myelin sulfatides. Nutr Biochem.2010 Nov;21(11):1083-8.
- Vitamin K and sphingolipid metabolism: evidence to date. Nutr Rev.2005 Apr;63(4):111-21.
- Bourre JM. Effects of nutrients (in food) on the structure and function of the nervous system: update on dietary requirements for brain. Part 1: micronutrients. J Nutr Health Aging. 2006 Sep-Oct;10(5):377-85.
- Bourre JM. Effects of nutrients (in food) on the structure and function of the nervous system: update on dietary requirements for brain. Part 2 : macronutrients. J Nutr Health Aging. 2006 Sep-Oct;10(5):386-99.

Colored Foods

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Why Deeply Pigmented?

- Pigments (especially **blue**/**purple**/**black**) are associated with improved cognitive performance and neuroprotection

Blueberries and Mild Cognitive Impairment (MCI)

- N = 47 with MCI, 68 y/o +, Blueberry powder vs. placebo, 16 weeks, equivalent of 1 cup berries
  - "There was improvement in cognitive performance and brain function compared with placebo"

- N = 94, 62 to 80 y/o with memory complaints
- Fish oil + blueberries vs. fish oil + placebo, 24 weeks
- The blueberry-supplemented participants had a better sense of well-being, fewer memory mistakes and were less inefficient

GENOVA DIAGNOSTICS

Krikorian R, et. al. Blueberry supplementation improves memory in older adults. *J Agric Food Chem*. 2010 Apr 14;58(7):3996-4000.

Funding for the studies was provided by the US Highbush Blueberry Council, the National Institute on Aging, and Wild Blueberries of North America.

Dr. Krikorian has disclosed no relevant financial relationships.

Pigment & Blueberry References

- Medicinal Effect of Nutraceutical Fruits for the Cognition and Brain Health. Scientifica (Cairo).2016;2016:3109254.
- Berry antioxidants: small fruits providing large benefits. J Sci Food Agric. 2014 Mar 30;94(5):825-33
- Dietary and plant polyphenols exert neuroprotective effects and improve cognitive function in cerebral ischemia. Recent Pat Food Nutr Ag. 2013 Aug;5(2):128-43.
- The impact of fruit flavonoids on memory and cognition. Br J Nutr. 2010 Oct;104 Suppl 3:S40-7.
- Grape juice, berries, and walnuts affect brain aging and behavior. J Nutr. 2009 Sep;139(9):1813S-7S.
- Fruit polyphenolics and brain aging: nutritional interventions targeting age-related neuronal and behavioral deficits. Ann N Y Acad Sci. 2002 Apr;959:128-32.
- Reversing the deleterious effects of aging on neuronal communication and behavior: beneficial properties of fruit polyphenolic compounds. Am J Clin Nutr. 2005 Jan;81(1 Suppl):313S-316S.

3 Greens

3 Colored

3 Sulfur

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Why Organ Meat

- Pre-industrial: 30% of all meat consumed was organ meat
- Excellent source of ubiquinone, minerals, essential fatty acids, fat and water soluble vitamins, especially
  - Vitamin K2-MK4
  - Retinol, Vitamin A

Organ Meat = Superfood

Minerals (mg/100g)	Kale	Turkey (roasted)	Beef Liver	Beef Heart
Calcium	72	26	6	94
Iron	0.9	1.79	6.54	1.17
Magnesium	18	25	21	23
Phosphorus	28	203	497	36
Potassium	228	280	352	296
Sodium	23	68	79	30
Zinc	0.24	2.96	5.3	0.31

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USDA Information from US National Nutrient Database for Standard Reference https://ndb.nal.usda.gov/ndb/foods

Vitamins (per 100g)	Kale	Turkey (roasted)	Beer Liver	Beef Heart
Vitamin C, mg	41	0	1.9	53.3
Thiamin mg	0.053	0.057	0.194	0.069
Riboflavin mg	0.07	0.177	3.425	0.091
Niacin mg	0.5	5.088	17.525	0.65
Vitamin mg B-6	0.138	0.41	1.017	0.179
Folate, mcgDFE	13	7	253	17
Vitamin B-12µg	0	0.35	70.58	0
Vitamin A, RAE	681 mcg	0	9442 mcg	885 mcg
Vitamin A, IU	13621 *	0.34	31714	17707
Vitamin E mg (alpha-tocopherol)	0.85	0	0.51	1.1
Vitamin K1 µg (phyloquinone)	817 (K1)	1.3	3.3 (K2)	0.5

Grass-fed Meats, Organ Meats, and Wild Fish

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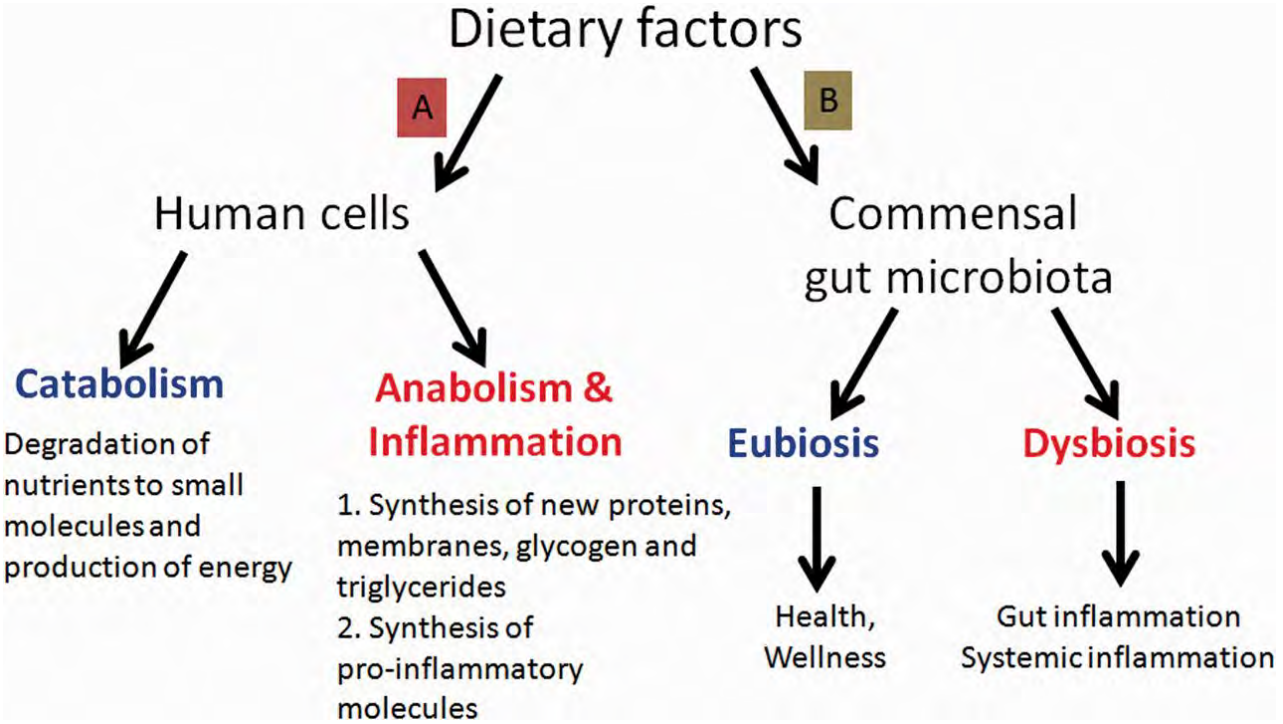
Figure 1. The two routes by which diet can influence our health: (A) the metabolism of our cells and (B) the population of our gut microbiota.



ASN NEURO

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Paolo R, et. al. *Neuro* 2015;7:1759091414568185.

Life Begins in the Ocean

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By Tiago Fioreze - https://commons.wikimedia.org/w/index.php?curid=6111892

Life Timeline Billions of Years

Going back in time billions of years

- 4.5 Water
- 4.0 Simple life
- 3.0 Photosynthesis
- 2.5 Oxygen crisis
- 1.5 Mitochondria Multi-cellular
- 0.5 (500 Million) Land plants/ animals
- 0.2 (200 Million) Mammals
- 0.00025 (250 Thousand) Humans
- 0.00001 (10 Thousand) Grain, legumes and dairy

Our Human Ecosystem Began In The Ocean

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By Tiago Fioreze - https://commons.wikimedia.org/w/index.php?curid=6111892

- We have co-evolved with the organisms that were in the ocean
- Microbes divide every 20 minutes (1 billion years)
  - Billions of generations
- Humans every 25 years (250,000 years)
  - 10,000 generations

Guts Populated by Ocean Microbiome

- Co-operative mutualistic relationship
- We are all supra-organisms – as dependent on the microbes as our cells are upon our mitochondria to function

Gut Brain Immune Axis

- Gut microbiota influence the brain and immune system balance
- Diet influences the microbiome strongly
- Exercise, sleep, stress level also important
- Changes in the colon mucosa every early in the disease process

Adamczyk-Sowa M, et. al. *J Immunol Res*. 2017;2017:790482.
Tremlett H, et. al. *Ann Transl Med*. 2017 Feb;5(3):53.
Zhu X, et. al. *Exp Mol Med*. 2017 May 26;49(5):e339.
Zhu X, et. al. *Oncotarget*. 2017 May 10.
Lee N, et. al. *Exp Mol Med*. 2017 May; 49(5): e340.
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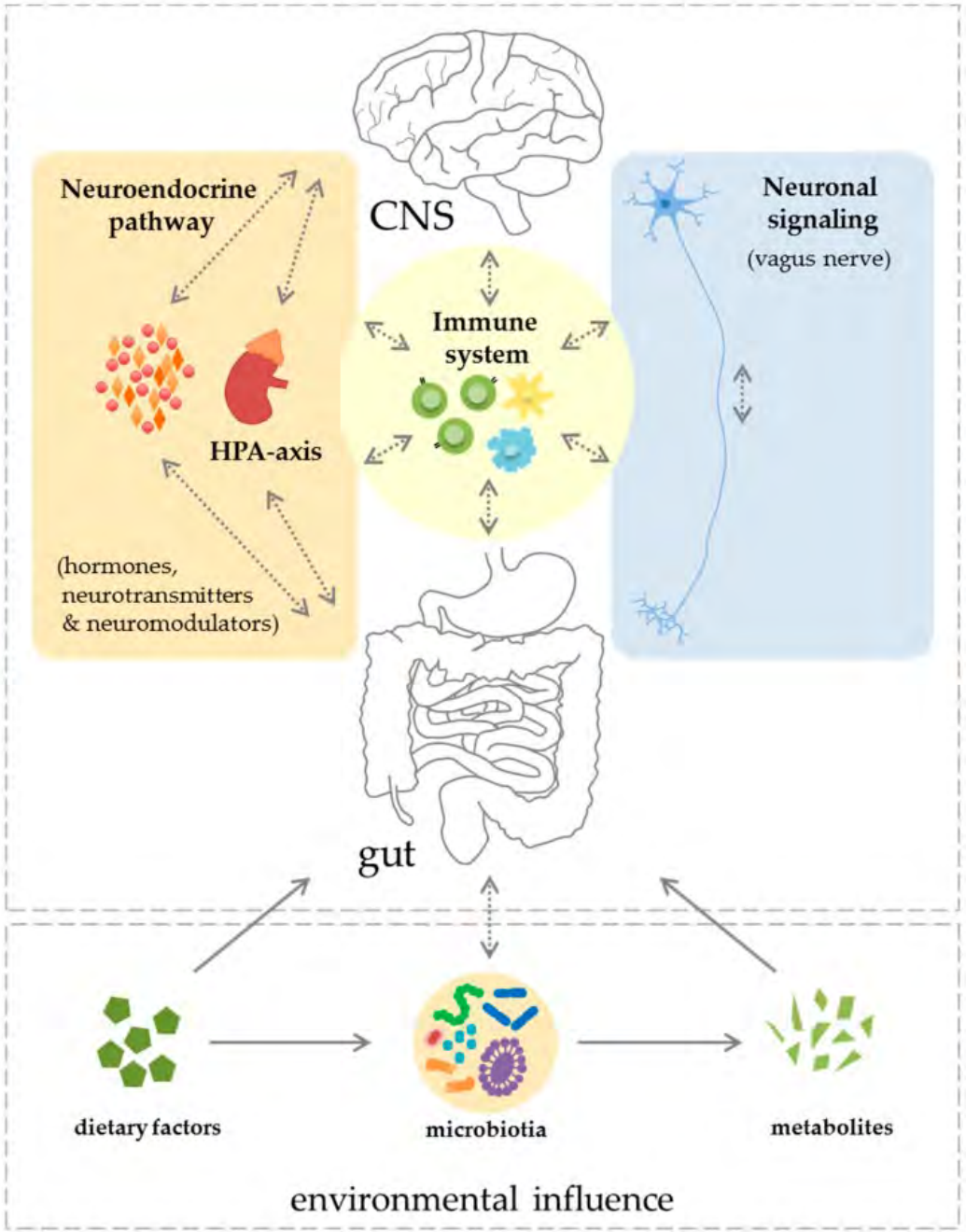
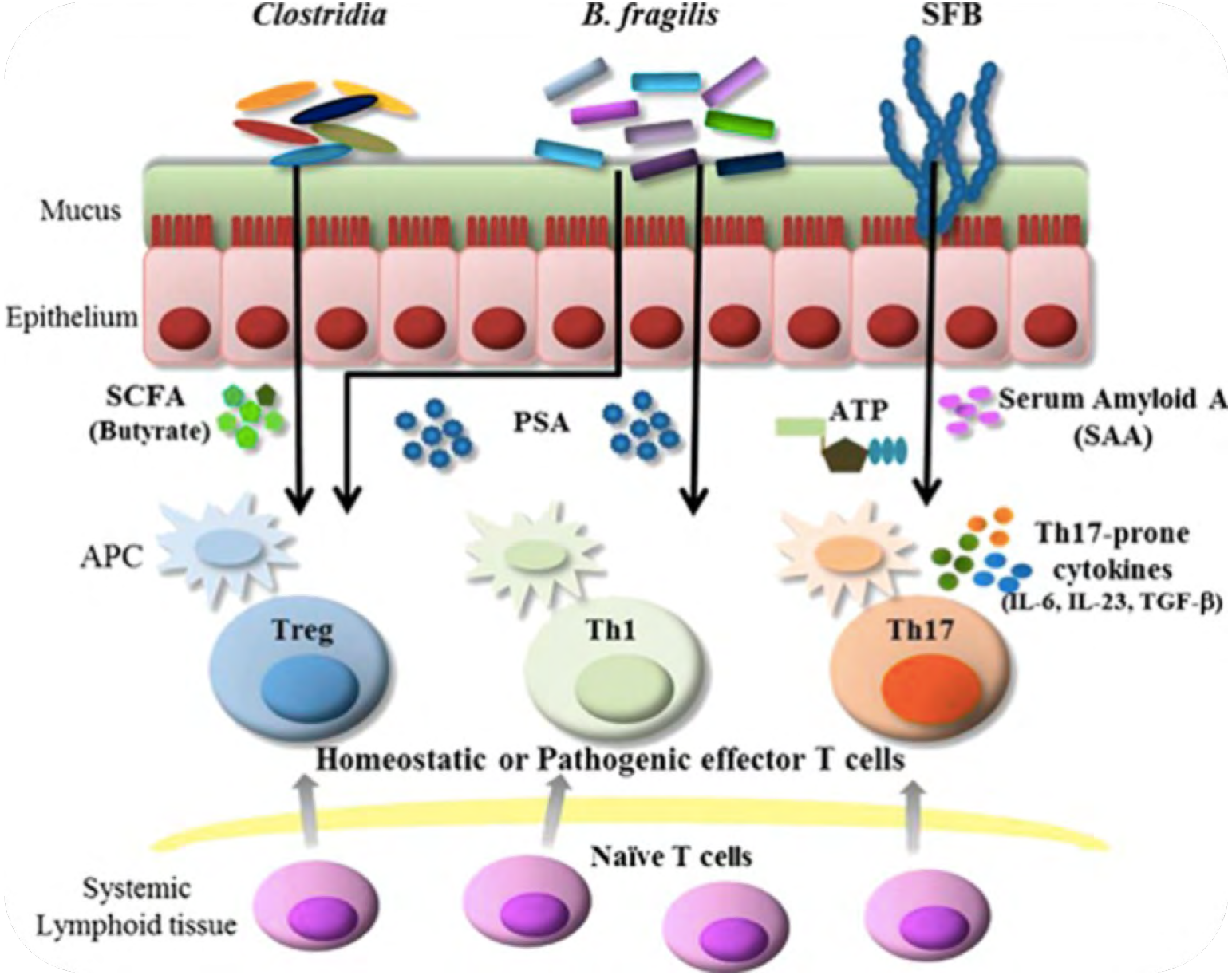
Gut–CNS-Axis

Possibility to Modulate Inflammatory Disease Activity—Implications for Multiple Sclerosis



Fleck AK, et. al. *Int J Mol Sci*. 2017 Jul; 18(7): 1526.



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Lee N, et. al. *Exp Mol Med*. 2017 May; 49(5): e340.

Microbiome and MS

- 20 MS patients
- 40 Controls
- Depletion of *Clostridia* species related to priming the regulatory Th17 cells
- Loss of T regulatory cells / tolerance

Dysbiosis in the Gut Microbiota of Patients with Multiple Sclerosis, with a Striking Depletion of Species Belonging to *Clostridia* XIVa and IV Clusters

Sachiko Miyake, Sangwan Kim, Wataru Suda, Kenshiro Oshima, Masakazu Nakamura, Takako Matsuoka, Norio Chihara, Atsuko Tomita, Wakiro Sato, Seok-Won Kim, Hidetoshi Morita, Masahira Hattori, Takashi Yamamura

Published: September 14, 2015 • https://doi.org/10.1371/journal.pone.0137429

Article | Authors | Metrics | Comments | Related Content

Abstract
Introduction
Materials & Methods
Results
Discussion
Supporting Information
Acknowledgments
Author Contributions
References

Abstract

The pathogenesis of multiple sclerosis (MS), an autoimmune disease affecting the brain and spinal cord, remains poorly understood. Patients with MS typically present with recurrent episodes of neurological dysfunctions such as blindness, paresis, and sensory disturbances. Studies on experimental autoimmune encephalomyelitis (EAE) animal models have led to a number of testable hypotheses including a hypothetical role of altered gut microbiota in the development of MS. To investigate whether gut microbiota in patients with MS is altered, we compared the gut microbiota of 20 Japanese patients with relapsing-remitting (RR) MS (MS20) with that of 40 healthy Japanese subjects (HC40) and an additional 18 healthy subjects (HC18). All the HC18 subjects repeatedly provided fecal samples over the course of months (158 samples in total). Analysis of the bacterial 16S ribosomal RNA (rRNA) gene by using a

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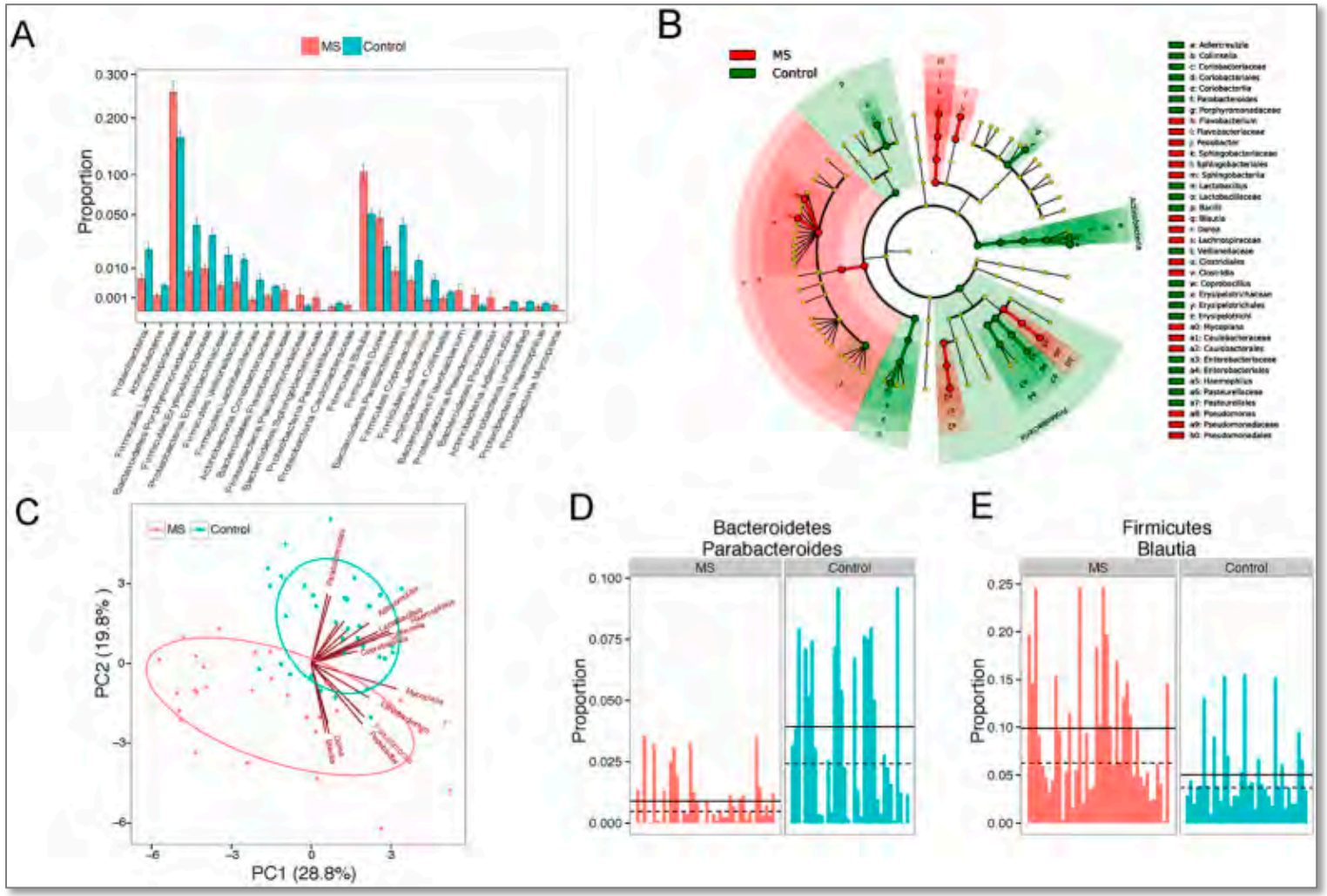
Sachiko M, et. al. *PLoS One*. 2015 Sep 14;10(9):e0137429.

Multiple Sclerosis Patients Have Gut Dysbiosis



Multiple sclerosis patients have a distinct gut microbiota compared to healthy controls

MS (n=31) More: *Psuedomonas, Mycoplana, Haemophilus, Blautia,* and *Dorea*

Control (n=36) More: *Parabacteroides, Adlercreutzia* and *Prevotella*

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Chen J, et. al. Sci Rep. 2016 Jun 27;6:28484.

Fiber Grams / Day

- Westernized society: 15 grams
- Target: 30 grams
- Wahls Diet: 80 grams
- Hunter Gatherer: 100 to 150 grams
- Feed your bacterial friends more fiber

BRISTOL STOOL CHART

Type 1	Separate hard lumps	Very constipated
Type 2	Lumpy and sausage like	Slightly constipated
Type 3	A sausage shape with cracks in the surface	Normal
Type 4	Like a smooth, soft sausage or snake	Normal
Type 5	Soft blobs with clear-cut edges	Lacking fibre
Type 6	Mushy consistency with ragged edges	Inflammation
Type 7	Liquid consistency with no solid pieces	Inflammation

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More Vegetables

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Study Diet

Food	Instruction	Servings
Green leafy vegetables	Recommended*	3 cups cooked/6 cups raw=3srvg
Sulfur-rich vegetables	Recommended*	3 cups raw or cooked= 3srvg
Intensely colored fruits or vegetables	Recommended*	3 cups raw or cooked =3 srvg
Omega-3 oils	Encouraged	2 tablespoons
Animal protein	Encouraged	4 ounces or more
Gluten-containing grain	Excluded	
Dairy	Excluded	
Eggs	Excluded	

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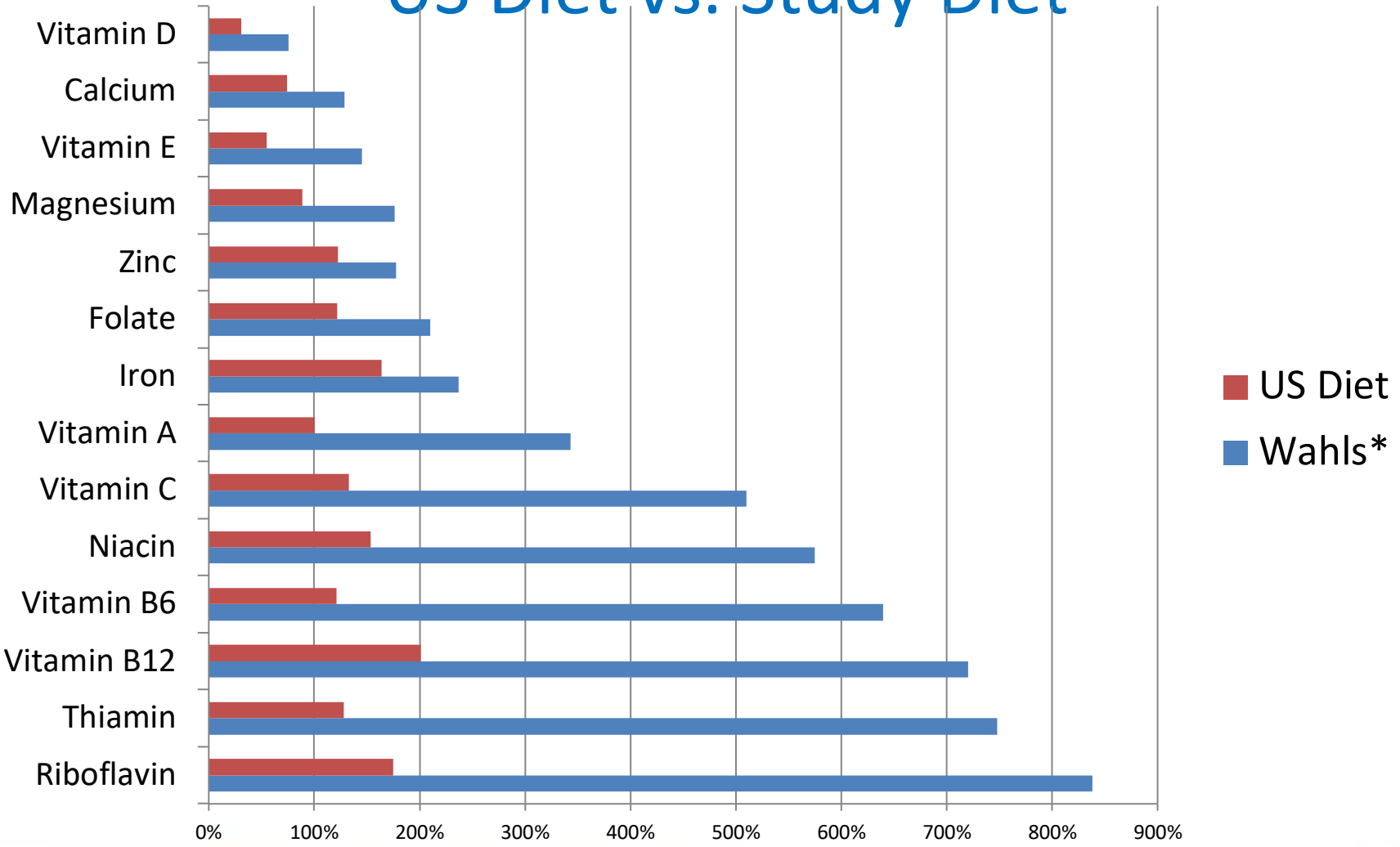
Nutritional Adequacy (%RDA)
US Diet vs. Study Diet



Stop Processed Foods, Gluten, Dairy, Eggs

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Methyl B12, Methyl Folate, Vitamin D, Fish Oil

http://vitaminreviewsite.com/wp-content/uploads/2013/04/natural-Vitamins.jpg

Meditation

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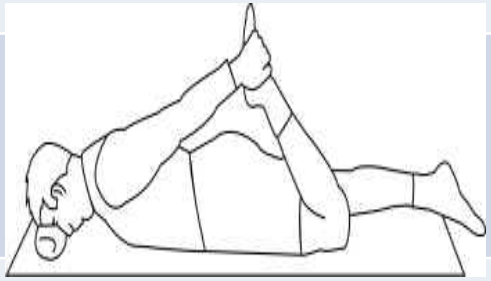
Stretching Exercises

Gastro-soleus

Hamstring

Quadriceps



Erector spinae

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Electrical Stimulation of Muscles Builds Muscle Mass

GENOVA DIAGNOSTICS

Degenerative Neurological and Neuromuscular Disease

Dovepress

ORIGINAL RESEARCH

Multimodal intervention improves fatigue and quality of life in subjects with progressive multiple sclerosis: a pilot study

This article was published in the following Dove Press journal:
Degenerative Neurological and Neuromuscular Disease
27 February 2015
Number of times this article has been viewed

Babita Bisht[1]
Warren G Darling[2]
E Torage Shivapour[3]
Susan K Lutgendorf[4–6]
Linda G Snetselaar[7]
Catherine A Chenard[1]
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[1]Department of Internal Medicine, Carver College of Medicine, University of Iowa, [2]Department of Health and Human Physiology, College of Liberal Arts and Sciences, University of Iowa, [3]Department of Neurology, Carver College of Medicine, University of Iowa, [4]Department of Psychology, College of Liberal Arts and Sciences, University of Iowa, [5]Department of Obstetrics and Gynecology, Carver College of Medicine, University of Iowa, [6]Department of Urology, Carver College of Medicine, University of Iowa, [7]Department of Epidemiology, College of Public Health, University of Iowa, [8]Department of Internal Medicine, VA Medical Center, Iowa City, IA, USA

Background: Fatigue is a disabling symptom of multiple sclerosis (MS) and reduces quality of life. The aim of this study was to investigate the effects of a multimodal intervention, including a modified Paleolithic diet, nutritional supplements, stretching, strengthening exercises with electrical stimulation of trunk and lower limb muscles, and stress management on perceived fatigue and quality of life of persons with progressive MS.

Methods: Twenty subjects with progressive MS and average Expanded Disability Status Scale (EDSS) score of 6.2 (range: 3.5–8.0) participated in the 12-month phase of the study. Assessments were completed at baseline and at 3 months, 6 months, 9 months, and 12 months. Safety analyses were based on monthly side effects questionnaires and blood analyses at 1 month, 3 months, 6 months, 9 months, and 12 months.

Results: Subjects showed good adherence (assessed from subjects' daily logs) with this intervention and did not report any serious side effects. Fatigue Severity Scale (FSS) and Performance Scales-fatigue subscale scores decreased in 12 months ($P<0.0005$). Average FSS scores of eleven subjects showed clinically significant reduction (more than two points, high response) at 3 months, and this improvement was sustained until 12 months. Remaining subjects (n=9, low responders) either showed inconsistent or less than one point decrease in average FSS scores in the 12 months. Energy and general health scores of RAND 36-item Health Survey (Short Form-36) increased during the study ($P<0.05$). Decrease in FSS scores during the 12 months was associated with shorter disease duration ($r=0.511$, $P=0.011$), and lower baseline Patient Determined Disease Steps score ($r_s=0.563$, $P=0.005$) and EDSS scores ($r_s=0.501$, $P=0.012$). Compared to low responders, high responders had lower level of physical disability ($P<0.05$) and lower intake of gluten, dairy products, and eggs ($P=0.036$) at baseline. High responders undertook longer duration of massage and stretches per muscle ($P<0.05$) in 12 months.

Conclusion: A multimodal intervention may reduce fatigue and improve quality of life of subjects with progressive MS. Larger randomized controlled trials with blinded raters are needed to prove efficacy of this intervention on MS-related fatigue.

Keywords: modified Paleolithic diet, exercise, neuromuscular electrical stimulation, stress management, lifestyle changes, vitamins, supplements

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Bisht B, Wahls TL, et. al. *Degen Neurol Neuromuscular Dis.* 2015: 19-35.

Subject Demographics

- 20 individuals (18 SPMS, 2 PPMS)
- Age: 51.7 (± 6.4) years
- Baseline EDSS: 6.2 (±1)
- Fatigue Severity Scale Score: 5.5 (± 1.2)

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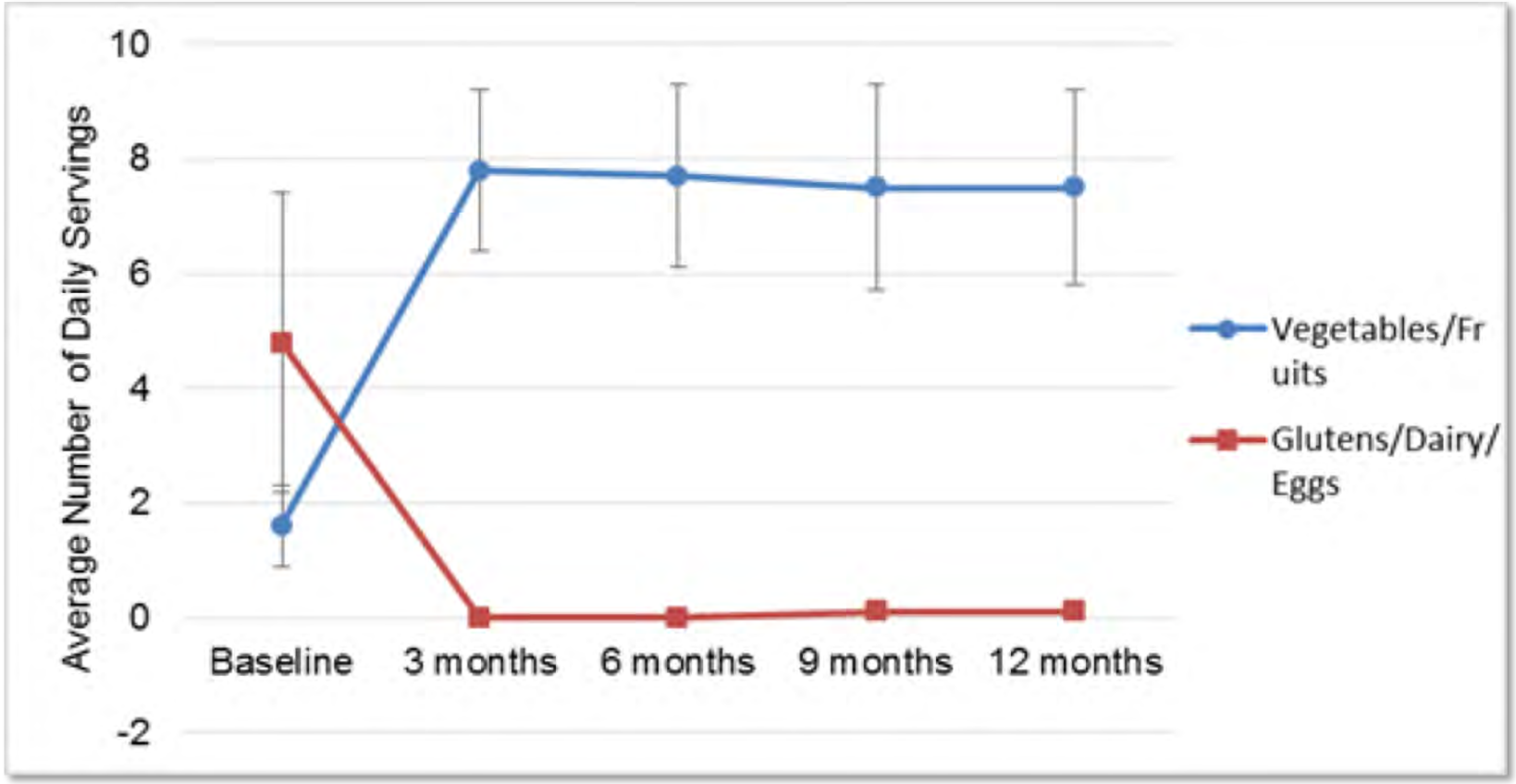
Average daily servings of the study diet recommended (vegetables/fruits) and excluded (gluten/dairy/eggs) foods $p < 0.01$ difference from baseline to 12 months



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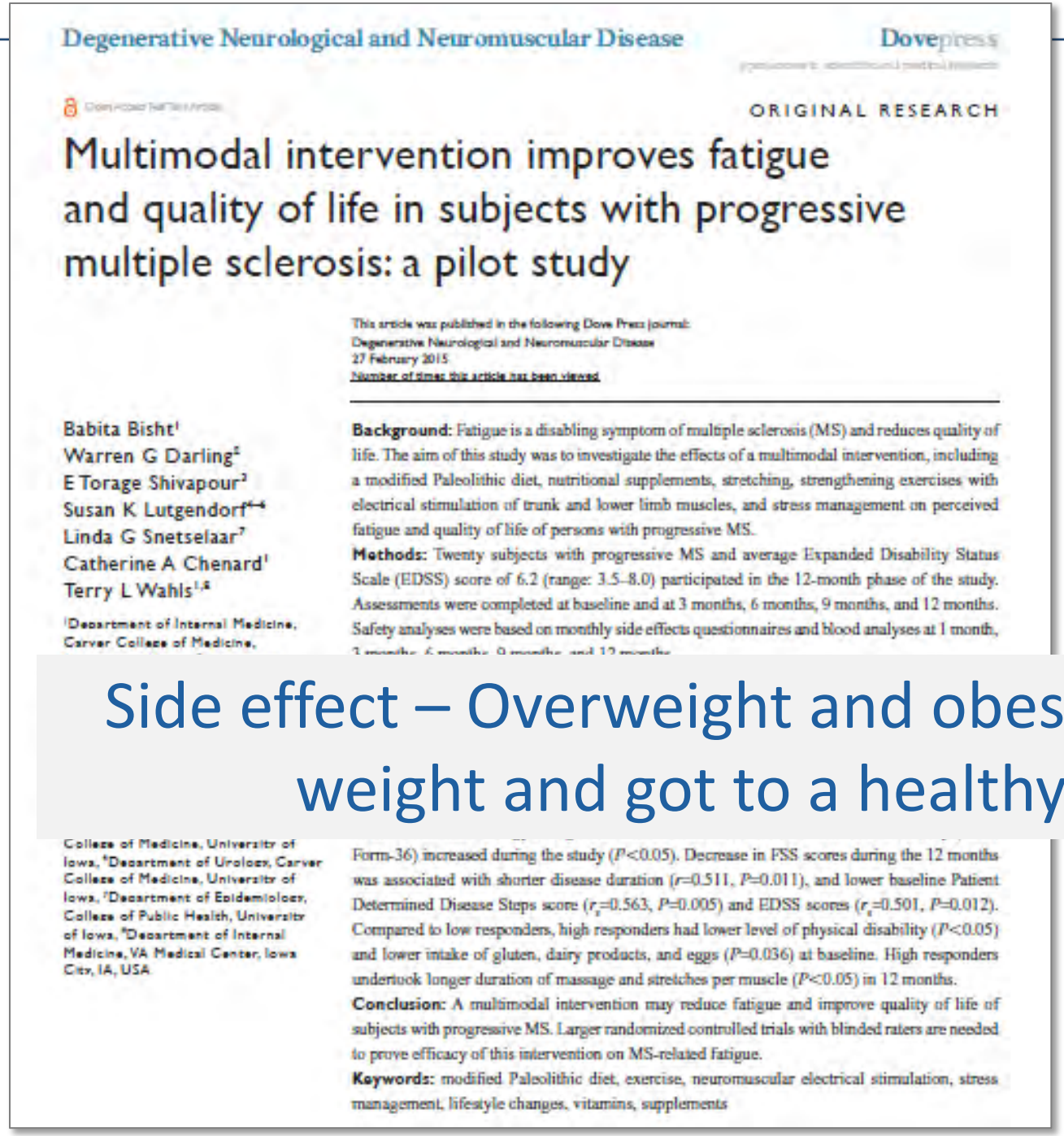

Degenerative Neurological and Neuromuscular Disease Dovepress

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Keywords: modified Paleolithic diet, exercise, neuromuscular electrical stimulation, stress management, lifestyle changes, vitamins, supplements

Side effect – Overweight and obese subjects lost weight and got to a healthy weight

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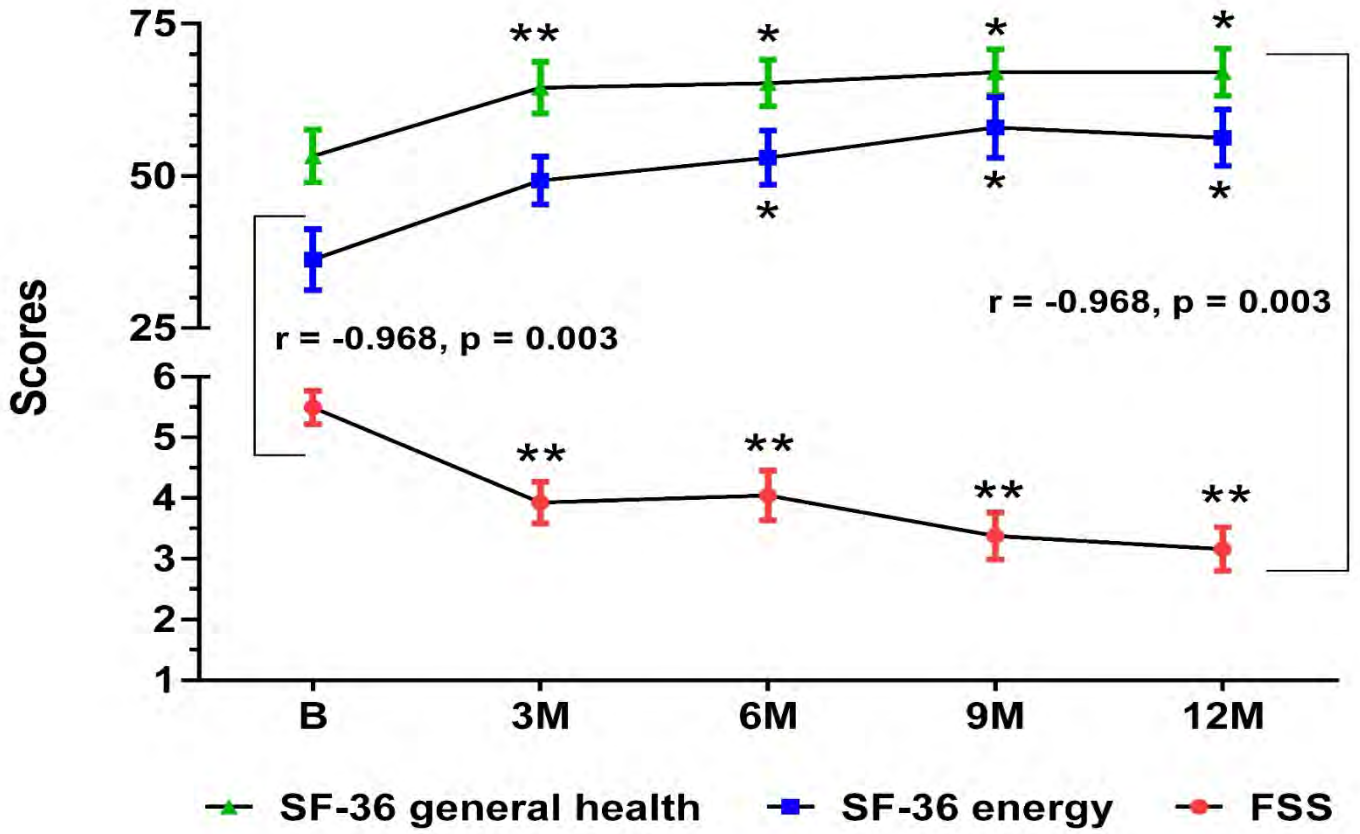
Bisht B, Wahls TL, et. al. *Degen Neurol Neuromuscular Dis.* 2015: 19-35.

Multimodal Intervention Improves Quality of Life
5 point change is clinically meaningful



**p<0.0005

*p< 0.05

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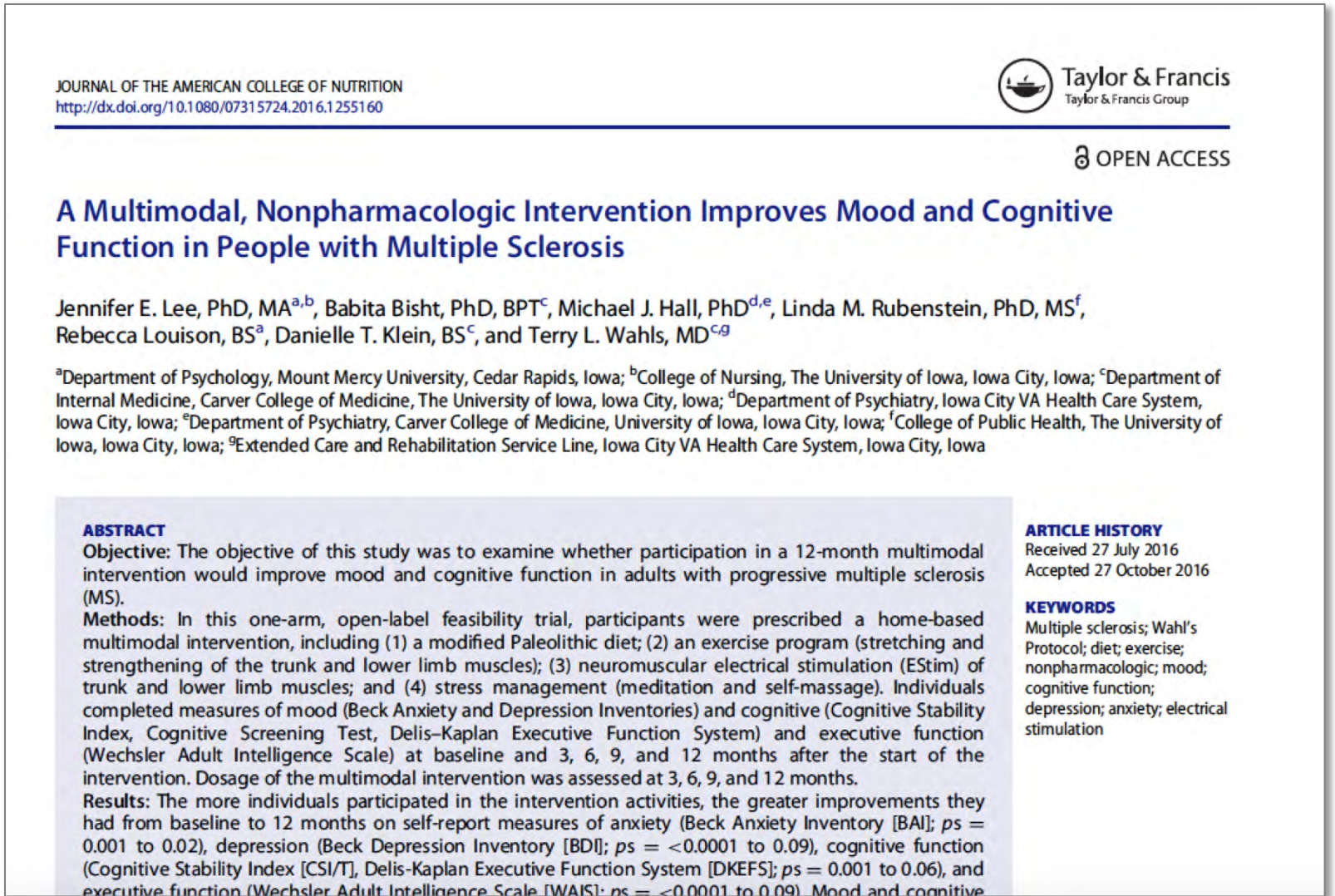
Factors Associated With Success

- Less disability
- Shorter disease duration
- Larger intervention Dose
- Family intervention / support (Diet)
- Exercise Dose (Gait)

In the Setting of Progressive MS

Improved Thinking Ability and Reduced Anxiety and Reduced Depression



JOURNAL OF THE AMERICAN COLLEGE OF NUTRITION
http://dx.doi.org/10.1080/07315724.2016.1255160

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A Multimodal, Nonpharmacologic Intervention Improves Mood and Cognitive Function in People with Multiple Sclerosis

Jennifer E. Lee, PhD, MA[a,b], Babita Bisht, PhD, BPT[c], Michael J. Hall, PhD[d,e], Linda M. Rubenstein, PhD, MS[f], Rebecca Louison, BS[a], Danielle T. Klein, BS[c], and Terry L. Wahls, MD[c,g]

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ABSTRACT

Objective: The objective of this study was to examine whether participation in a 12-month multimodal intervention would improve mood and cognitive function in adults with progressive multiple sclerosis (MS).

Methods: In this one-arm, open-label feasibility trial, participants were prescribed a home-based multimodal intervention, including (1) a modified Paleolithic diet; (2) an exercise program (stretching and strengthening of the trunk and lower limb muscles); (3) neuromuscular electrical stimulation (EStim) of trunk and lower limb muscles; and (4) stress management (meditation and self-massage). Individuals completed measures of mood (Beck Anxiety and Depression Inventories) and cognitive (Cognitive Stability Index, Cognitive Screening Test, Delis–Kaplan Executive Function System) and executive function (Wechsler Adult Intelligence Scale) at baseline and 3, 6, 9, and 12 months after the start of the intervention. Dosage of the multimodal intervention was assessed at 3, 6, 9, and 12 months.

Results: The more individuals participated in the intervention activities, the greater improvements they had from baseline to 12 months on self-report measures of anxiety (Beck Anxiety Inventory [BAI]; ps = 0.001 to 0.02), depression (Beck Depression Inventory [BDI]; ps = <0.0001 to 0.09), cognitive function (Cognitive Stability Index [CSI/T], Delis-Kaplan Executive Function System [DKEFS]; ps = 0.001 to 0.06), and executive function (Wechsler Adult Intelligence Scale [WAIS]; ps = <0.0001 to 0.09). Mood and cognitive

ARTICLE HISTORY
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KEYWORDS
Multiple sclerosis; Wahl's Protocol; diet; exercise; nonpharmacologic; mood; cognitive function; depression; anxiety; electrical stimulation

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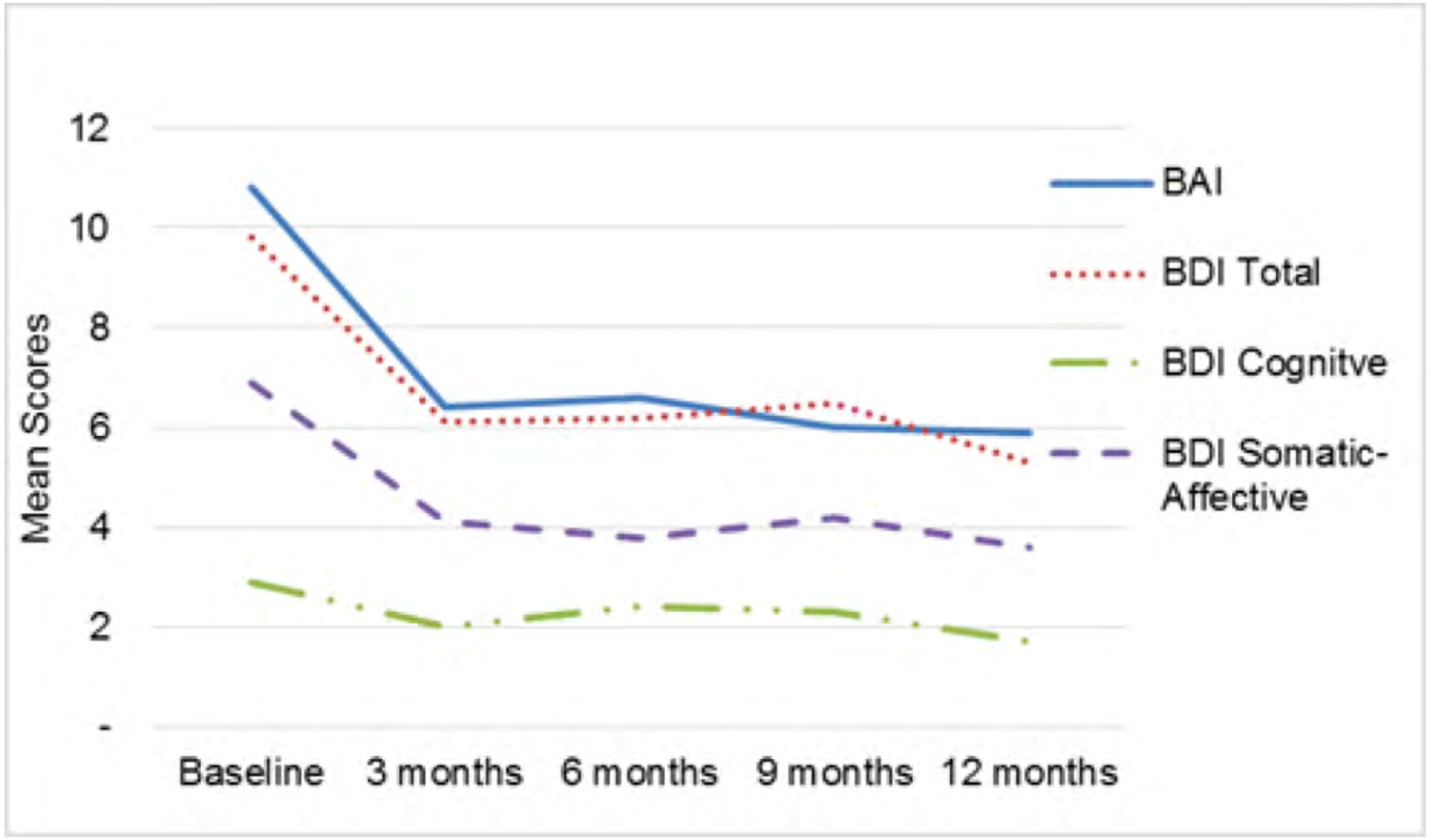
Lee JE, Wahls TL, et. al. *J Am Coll Nutr*. 2017 Apr 3;36(3):150-68.

Average Scores on the Mood Measures at Each Study Visit



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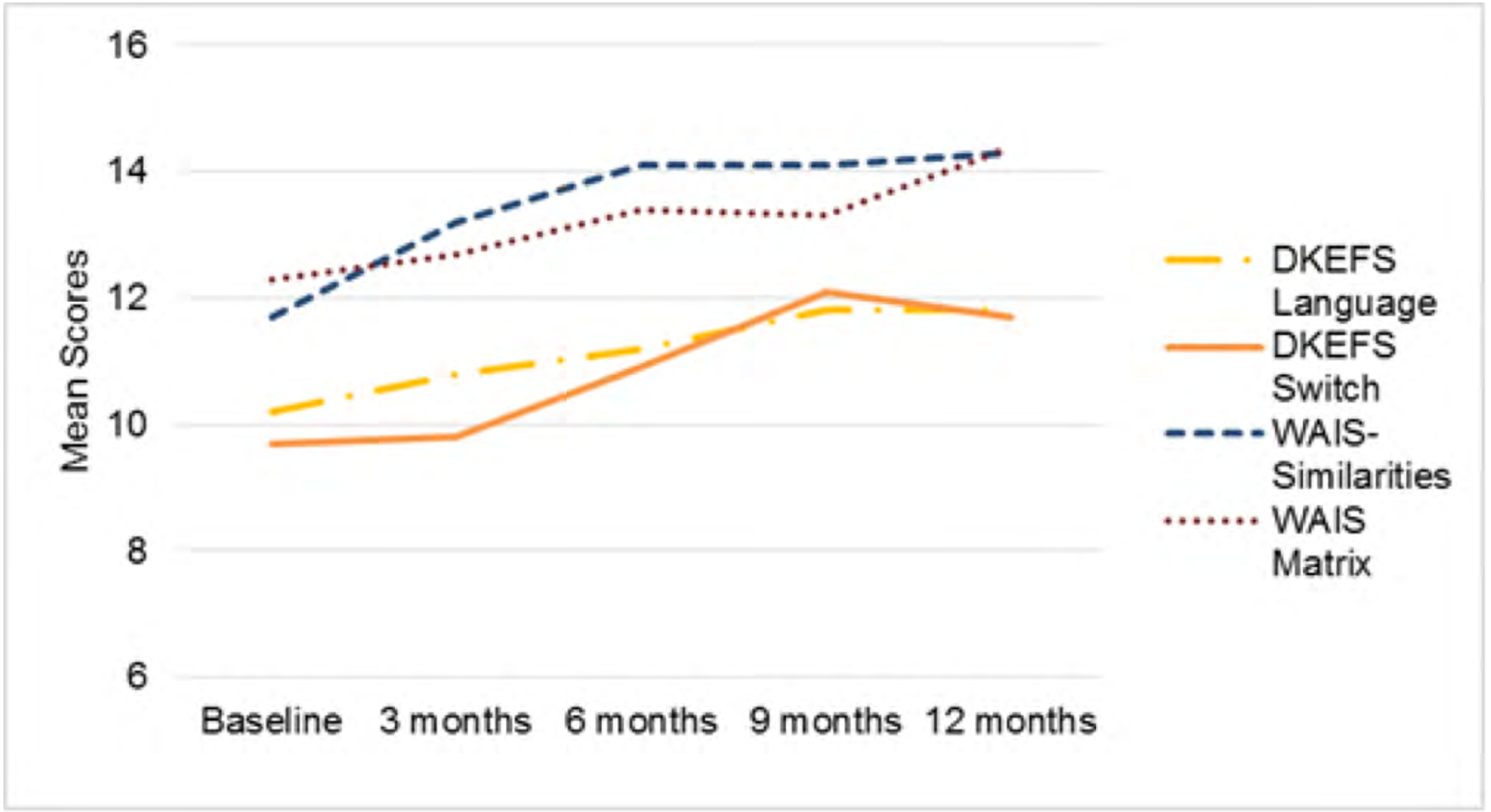
Average Scores on the DKEFS and WAIS Subscales at Each Study Visit



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Effects of a multimodal intervention on gait and balance of subjects with progressive multiple sclerosis: a prospective longitudinal pilot study
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Bisht B, Wahls TL, et. al. *Degener Neurol Neuromuscul Dis.* 2015, 5:91-92

In the Setting of Relapsing-remitting MS Reduction of Fatigue and Improved Motor Function

Degenerative Neurological and Neuromuscular Disease

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CLINICAL TRIAL REPORT

Randomized control trial evaluation of a modified Paleolithic dietary intervention in the treatment of relapsing-remitting multiple sclerosis: a pilot study

This article was published in the following Dove Press journal:
Degenerative Neurological and Neuromuscular Disease
4 January 2017
Number of times this article has been viewed

Amanda K Irish[1]
Constance M Erickson[1]
Terry L Wahls[2,3]
Linda G Snetselaar[4]
Warren G Darling[1]

[1]Motor Control Laboratories, Department of Health and Human Physiology, College of Liberal Arts and Sciences, The University

Background/objective: A Paleolithic diet may improve fatigue and quality of life in progressive multiple sclerosis (MS) patients, but past research has evaluated the effects of this dietary intervention in combination with other treatments such as exercise. Thus, the purpose of this pilot study was to evaluate a modified Paleolithic dietary intervention (MPDI) in the treatment of fatigue and other symptoms in relapsing-remitting MS (RRMS).

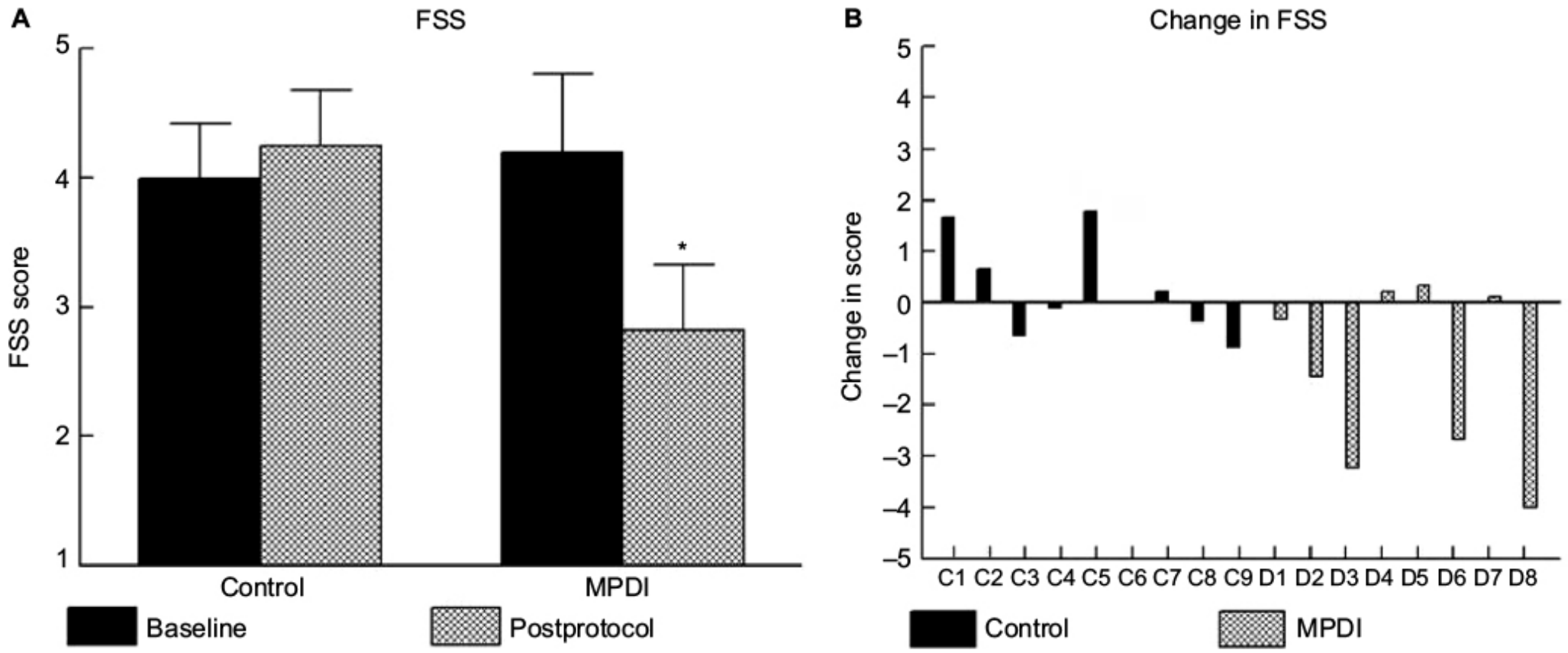
Methods: We measured the effects of a MPDI in 17 individuals with RRMS. Of 34 subjects randomly assigned to control (maintain usual diet) and intervention (MPDI) groups, nine subjects (one man) completed the control group and eight subjects (one man) completed the MPDI.

Results: Significant improvements were seen in Fatigue Severity Scale score and also in Mul-

GENOVA DIAGNOSTICS

Irish AK, Wahls TL, et. al. *Degener Neurol Neuromuscul Dis*. 2017 Jan 4;7:1-8.

Reduced Fatigue



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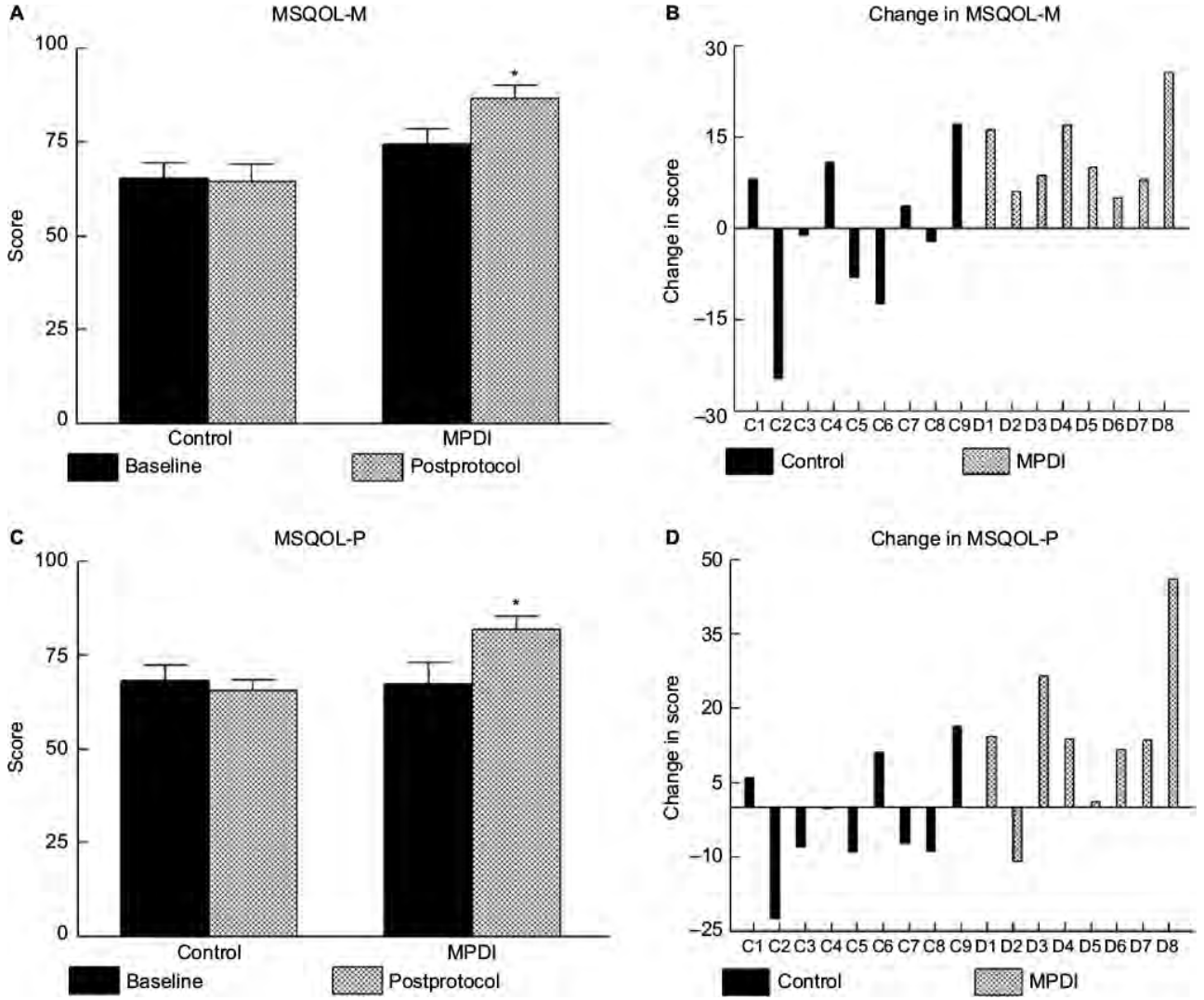
Improved Mental and Physical QoL



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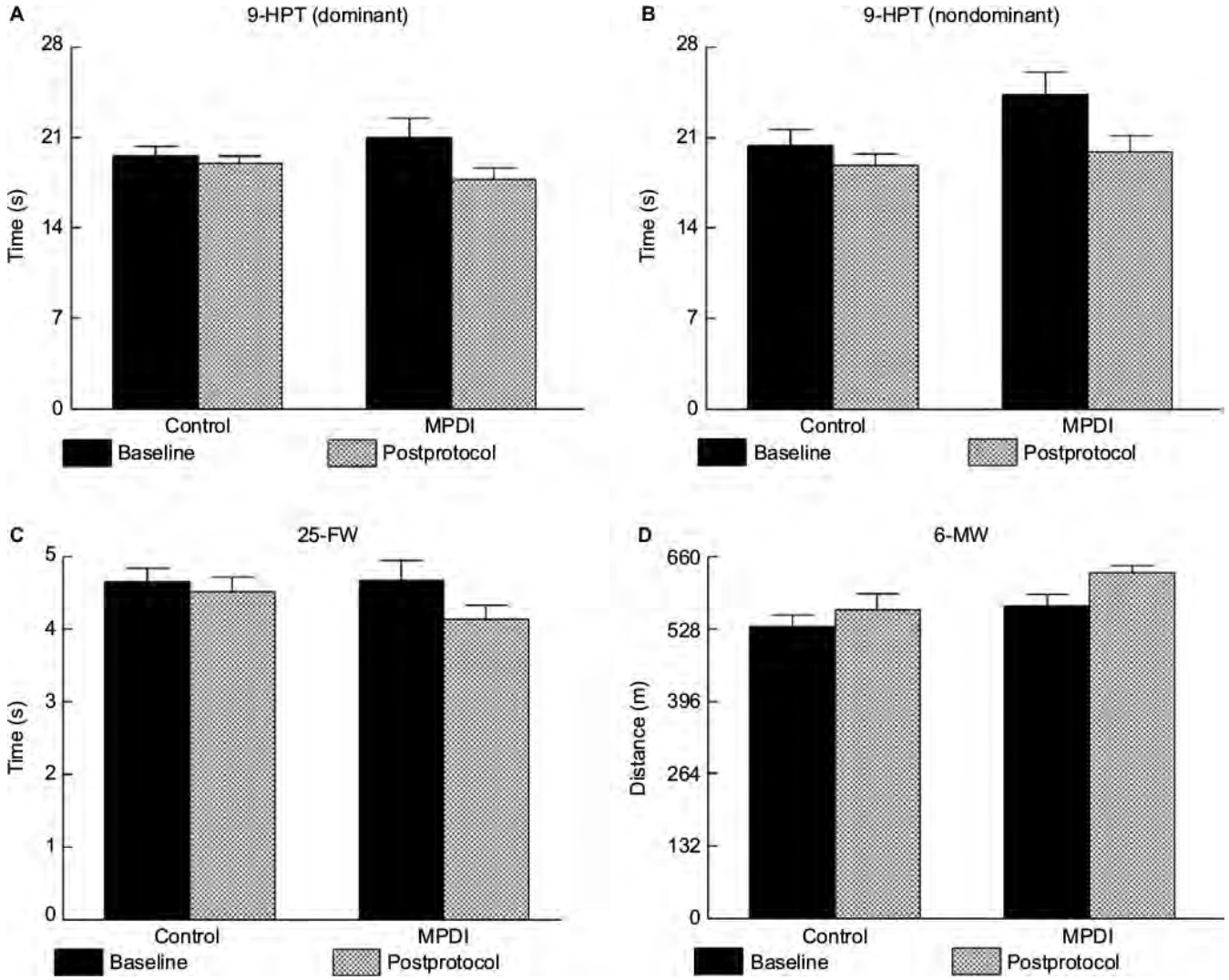
Improved Motor Function



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Family Time

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- Home Economics
- Family
- Adult skills
- Social skills
- Behaviors
- Academics
- Economic security
- Health outcomes
- Nutrition

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- Therapeutic lifestyle classes
- Group classes
- Introduction to concepts
- Intake ½ day
- 2 Hr MD – timeline and matrix
- 2 HR RD – healthy kitchen

- Support groups every other month
- Skills classes every month

Reasons for Referral

- Chronic pain (55%)
- Metabolic Issues (25%)
- Autoimmune (15%)
- TBI
- Fibromyalgia
- Mood disorders

Interventions

Primary Care Labs	Supplements
Vitamin D, B12, folate	Vitamin D
Homocysteine	Cod liver oil
Lipids (Trig/ HDL ratio)	
HbA1c	Methyl B12, methyl folate
ESR	
h.s. CRP	Algae, NAC

Outcomes Biometric

- Comparing those with 1 visit to 3+ visits
- BMI ↓
- HbA1c ↓
- Trig/HDL ratio ↓
- Vitamin D ↑
- Homocysteine ↓

Dietary Approaches to Treating MS Related Fatigue

- Recruiting for clinical trial
- Relapsing Remitting MS + fatigue
- Compare Swank and Wahls Diet
- MSDietStudy@healthcare.uiowa.edu
- Live within 500 miles of Iowa City, Iowa

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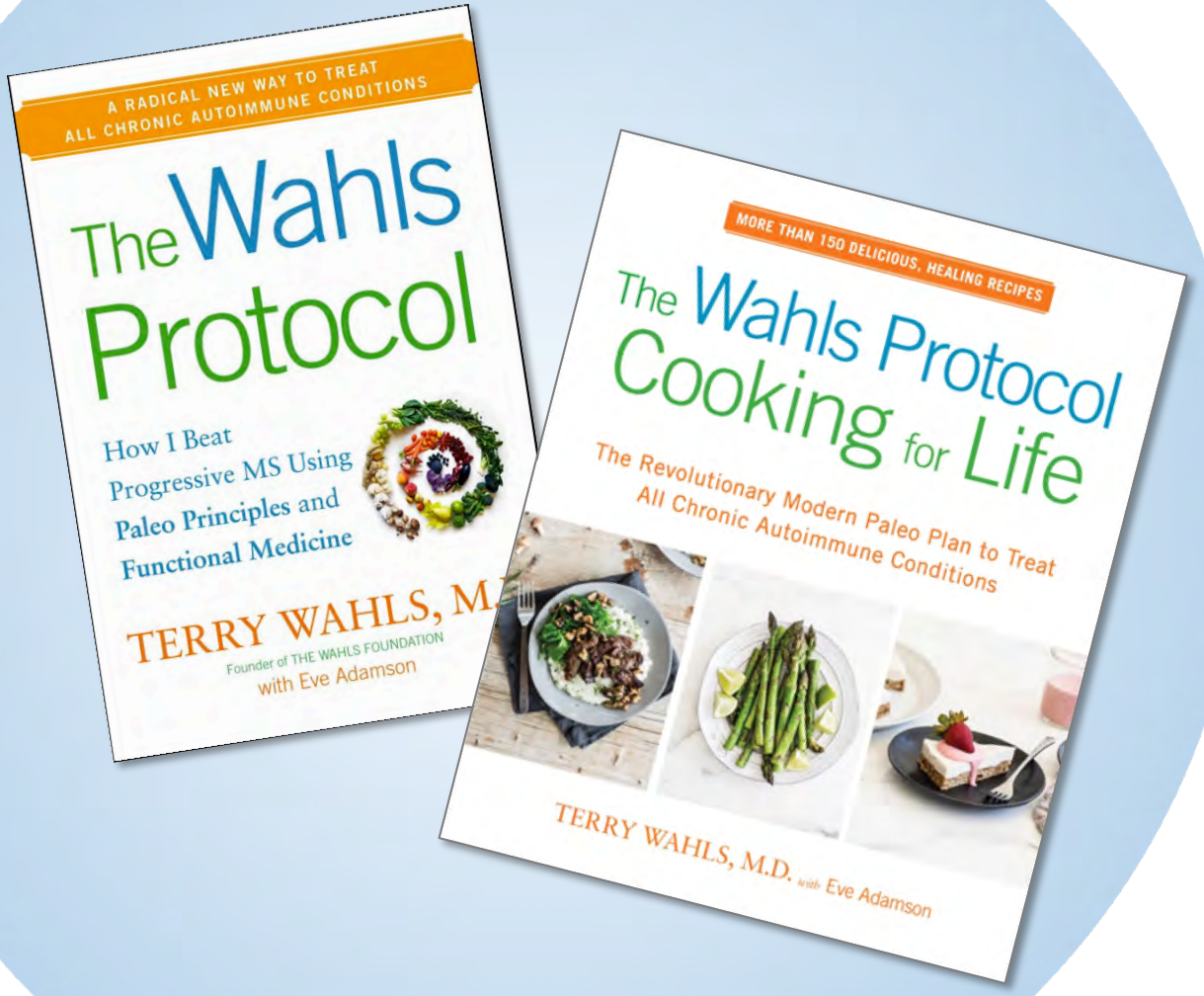

www.terrywahls.com

RRMS & Fatigue Study funded by NMSS

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Deanna Minich, PhD

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Dietary Approaches to Reducing MS Related Symptoms

Terry Wahls, MD, IFMCP

Author The Wahls Protocol How I Beat Progressive MS
Using Functional Medicine and Paleo Principles