A well-balanced approach to post-traumatic headache: Integrative approaches to evaluation and treatment

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Non-disclosure

None of the presenters have conflicts to report

The views expressed are those of the presenters

Presentation “Trail Map"

Visual Vestibular Phenotype

- -Clinical Sample
- -Findings
- -Clinical Implications
- -Clinical Guidance

Dietary Intervention for Post-traumatic Headache

- -Study Methods
- -Findings
- -Scientific Rationale
- -Practical Application

Visual-Vestibular Phenotype

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Transforming Health and Resilience in Veterans (THRIVE) Program

THRIVE PROGRAM

Mission: To fulfill our duty to serve Veterans and first responders by improving the evaluation and treatment of service-related traumatic brain injuries and PTSD through clinical practice, research, and education.

AVALON ACTION ALLIANCE

“Typical Patient”

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Male (~85%)

Mid-40’s (20’s to 70’s)

White/ Caucasian (~75%)

Army Veteran (~55%)

Some college/ College degree

THRIVE Program — Evaluation








THRIVE Program — Evaluation

THRIVE PROGRAM

Headache Impact Test (HIT-6)

Headache Impact Test (HIT-6) questionnaire was designed to help you describe and communicate the way you feel and what you cannot do because of headaches.

To complete, please circle one answer for each question.

1. When you have headaches, how often is the pain severe?
   never rarely sometimes very often always
2. How often do headaches limit your ability to do usual daily activities including household work, work, school or social activities?
   never rarely sometimes very often always
3. When you have a headache, how often do you wish you could lie down?
   never rarely sometimes very often always
4. In the past four weeks, how often have you felt too tired to do work or daily activities because of your headaches?
   never rarely sometimes very often always
5. In the past four weeks, how often have you felt fed up or irritated because of your headaches?
   never rarely sometimes very often always
6. In the past four weeks, how often did headaches limit your ability to concentrate on work or daily activities?
   never rarely sometimes very often always

NEVER 6 points … TOTAL SCORE

Higher scores …

Score range 36-78

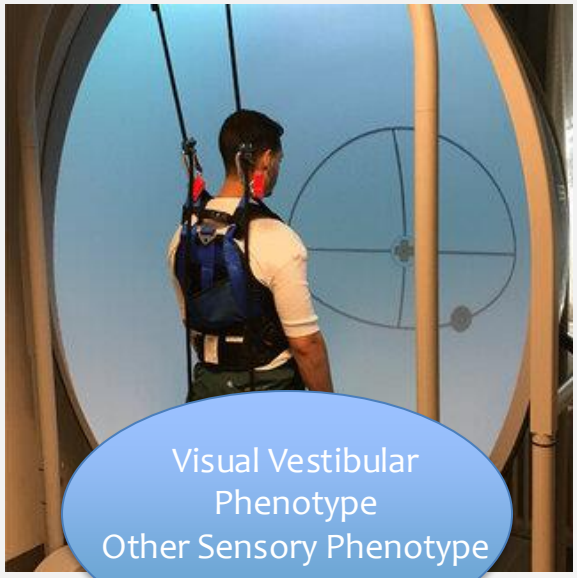
HIT-6
Total ≥56
Significant
Headache

The Dizziness Handicap Inventory (DHI)

P1. Does looking up increase your problem?	o Yes o Sometimes o No
E2. Because of your problem, do you feel frustrated?	o Yes o Sometimes o No
F3. Because of your problem, do you restrict your travel for business or recreation?	o Yes o Sometimes o No
P4. Does walking down the aisle of a supermarket increase your problems?	o Yes o Sometimes o No
F5. Because of your problem, do you have difficulty getting into or out of bed?	o Yes o Sometimes o No
F6. Does your problem significantly restrict your participation in social activities, such as going out to dinner, going to the movies, dancing, or going to parties?	o Yes o Sometimes o No
F7. Because of your problem, do you have difficulty reading?	o Yes o Sometimes o No
P8. Does performing more ambitious activities such as sports, dancing, household chores (sweeping or putting dishes away) increase your problems?	o Yes o Sometimes o No
E9. Because of your problem, are you afraid to leave your home without having someone accompany you?	o Yes o Sometimes o No
E10. Because of your problem have you been embarrassed in front of others?	o Yes o Sometimes o No
P11. Do quick movements of your head increase your problem?	o Yes o Sometimes o No
F12. Because of your problem, do you avoid heights?	o Yes o Sometimes o No
P13. Does turning over in bed increase your problem?	o Yes o Sometimes o No
F14. Because of your problem, is it difficult for you to do strenuous homework or yard work?	o Yes o Sometimes o No
E15. Because of your prob…	o Yes o Sometimes o No
F16. Because …	o Yes … metimes
P17. Does …	… imes
E18.Becau…	… etimes
F19. Because of yo… dark?	o Yes o Sometimes o No

DHI
Total ≥35
Significant
Dizziness

Sensory Organization Test (SOT)



Visual Vestibular Phenotype
Other Sensory Phenotype
WNL

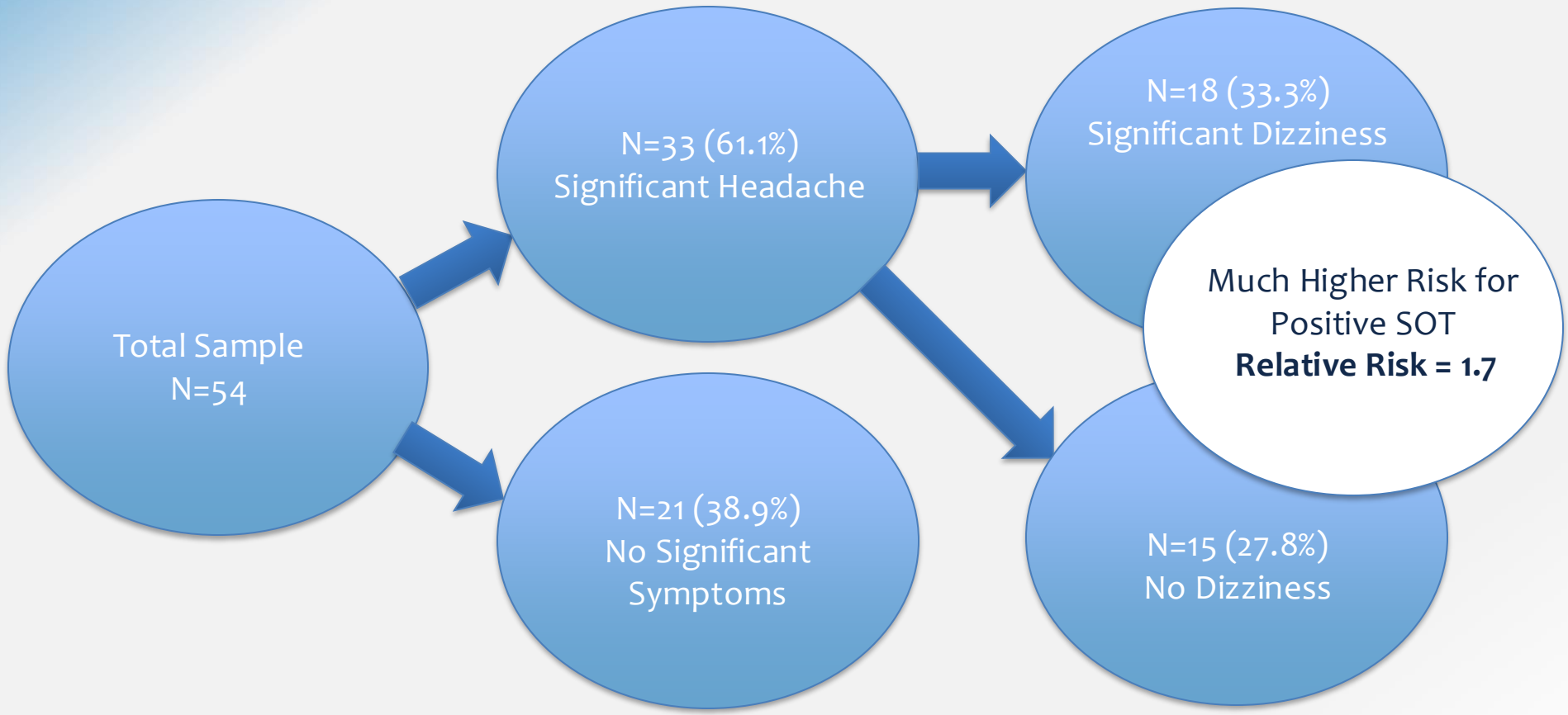
Primary Aim

Dizziness and headaches are common symptoms

Many patients without traditional vertiginous symptoms show vestibular disruptions

We sought to clarify the relationship between headaches, dizziness, and vestibular dysfunction

Results


Total Sample
N=54
N=33 (61.1%)
Significant Headache
N=21 (38.9%)
No Significant
Symptoms
N=18 (33.3%)
Significant Dizziness
N=15 (27.8%)
No Dizziness
Much Higher Risk for
Positive SOT
Relative Risk = 1.7

Results - ANOVA

	WNL n=17	VVP n=18	OSP n=19	*p*-value (η^2) post-hoc summary
HIT-6 % significant	50.1 (11.8) 35%	60.7 (10.0) 78%	56.6 (14.5) 68%	0.045 (0.11) (VVP>WNL, OSP)
DHI % significant	15.6 (19.1) 12%	31.0 (22.3) 28%	38.0 (22.3) 56%	0.002 (0.21) (OSP>WNL, VVP)

WNL = Within Normal Limits
VVP = Visual Vestibular Phenotype
OSP = Other Sensory Phenotype
Significant HIT-6 ≥56
Significant DHI ≥35
Small effect size $\eta^2 = 0.01$, Medium effect size $\eta^2 = 0.06$, Large effect size $\eta^2 = 0.14$.

Summary of Findings

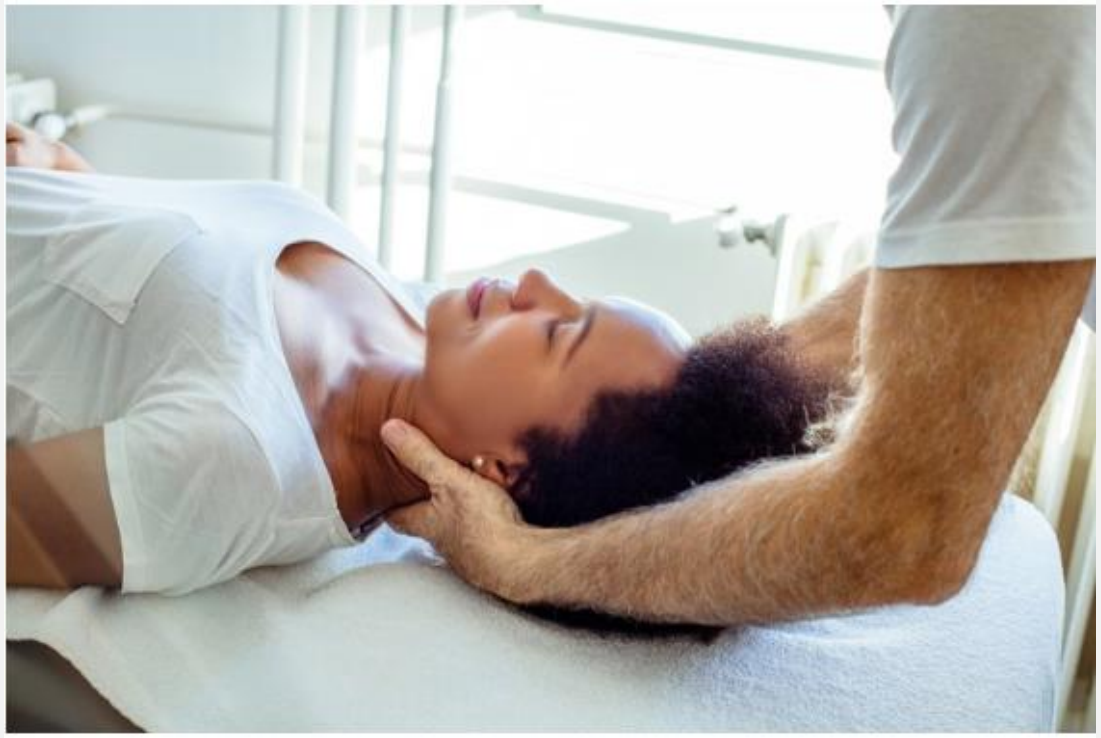
Headache… NOT dizziness… best predicted risk for SOT findings

Those with headache and no dizziness were more likely to have VVP

Those with headache AND dizziness were more likely to have other sensory phenotype

Lack of dizziness could lead to missing vestibular dysfunction

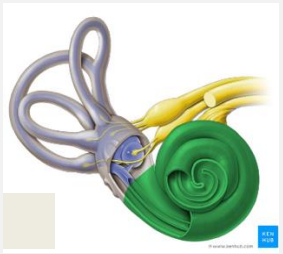
Clinical Implications



Spatial Orientation

Visual

Somatosensory



Vestibular

Sensory Organization Test

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Sensory Organizational Testing (SOT)

Are Somatosensory, Visual, & Vestibular systems recruited equally?

Sensory Organization Test

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Sensory Organization Test

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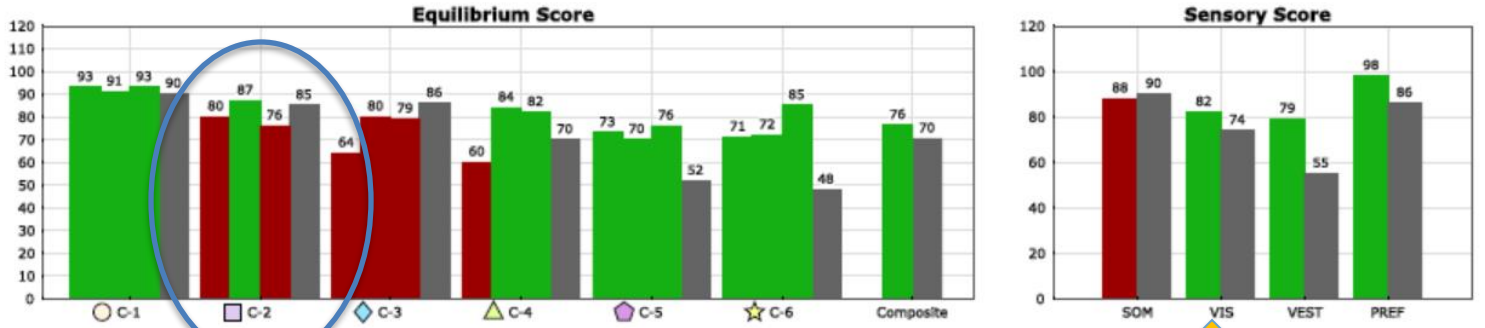
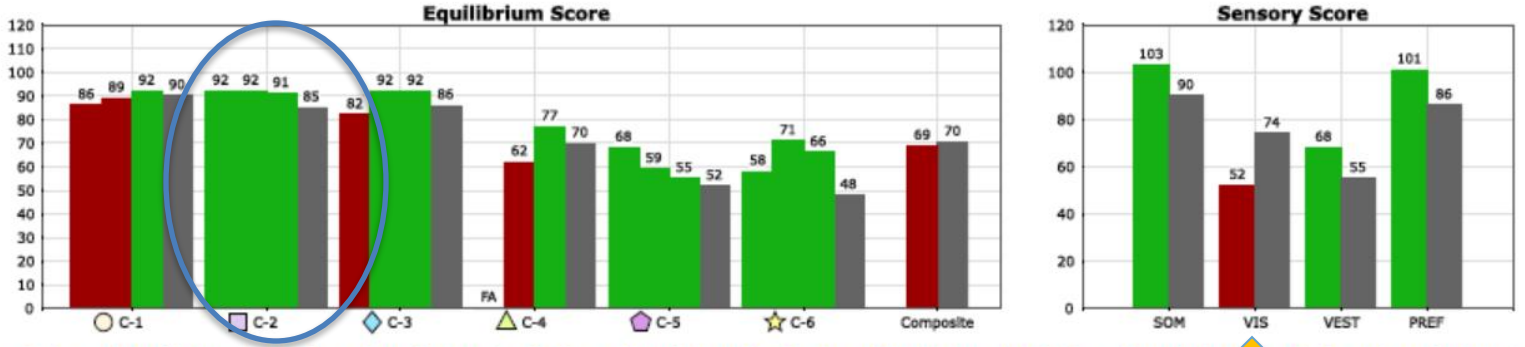
Visual Vestibular Phenotype (VVP)



C-1 = Condition 1, **C-2** = Condition 2, **C-3** = Condition 3, **C-4** = Condition 4, **C-5** = Condition 5, **C-6** = Condition 6
SOM = Somatosensory, **VIS** = Visual, **VEST** = Vestibular, **PREF** = Preference, **COG** = Center of Gravity

Somatosensory Vestibular Phenotype (SVP)



C-1 = Condition 1, **C-2** = Condition 2, **C-3** = Condition 3, **C-4** = Condition 4, **C-5** = Condition 5, **C-6** = Condition 6
SOM = Somatosensory, **VIS** = Visual, **VEST** = Vestibular, **PREF** = Preference, **COG** = Center of Gravity

Clinical Picture

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Traditional Vestibular Impairments "OSP"	VS	Visual Vestibular Phenotype "VVP"
• Dizziness • Imbalance on uneven terrain • Headaches at base of skull		• Visual fatigue • Vice-grip or ocular headache • Imbalance in dark or visually congested areas • Feeling "off"/ "buzzed" • Brain fog • Social withdrawal

Clinical Findings

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Headaches:
-Ocular
-Vice grip

Brain Fog
Cognitive
Impact

Intact
oculomotor
testing (VNG)

Moderately
abnormal
SOT testing

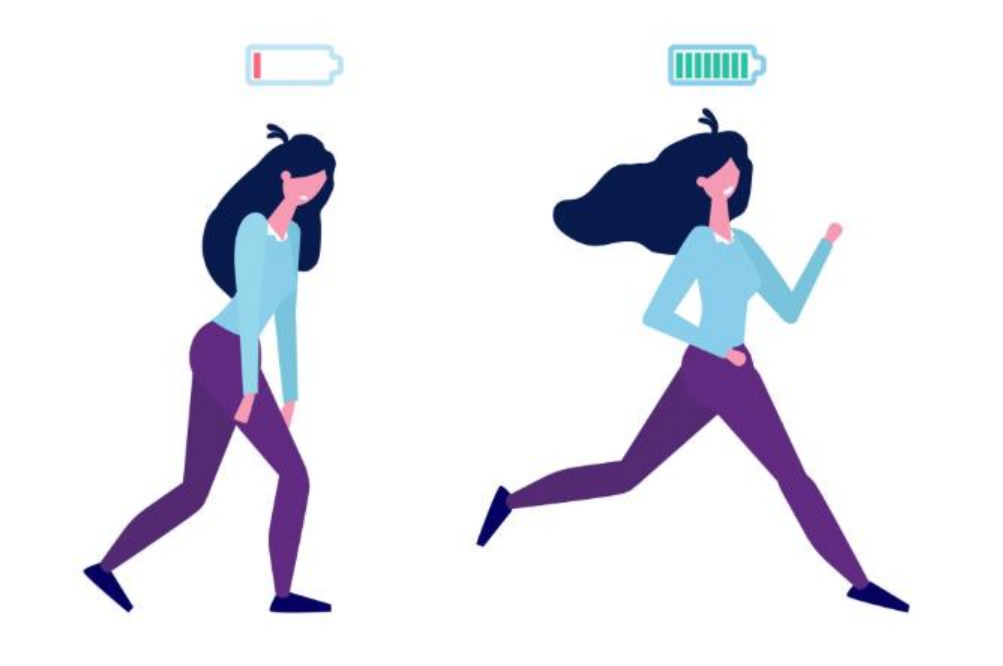
Combating Sensory Fatigue

PLAN & PRIORITIZE

PACE

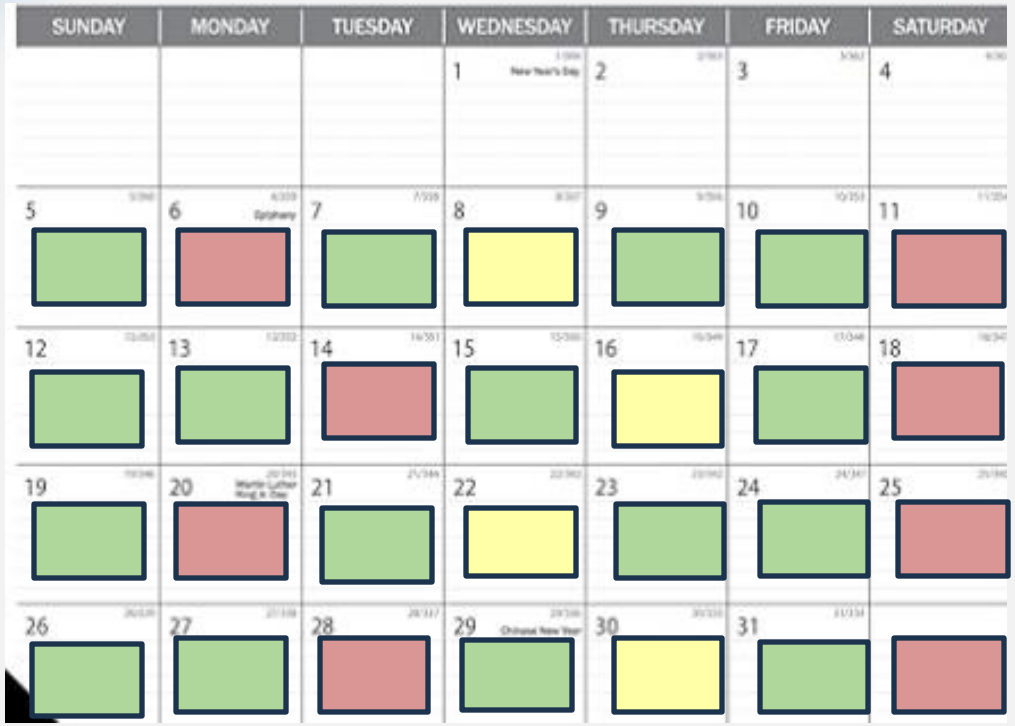
COMMUNICATE

GROUND

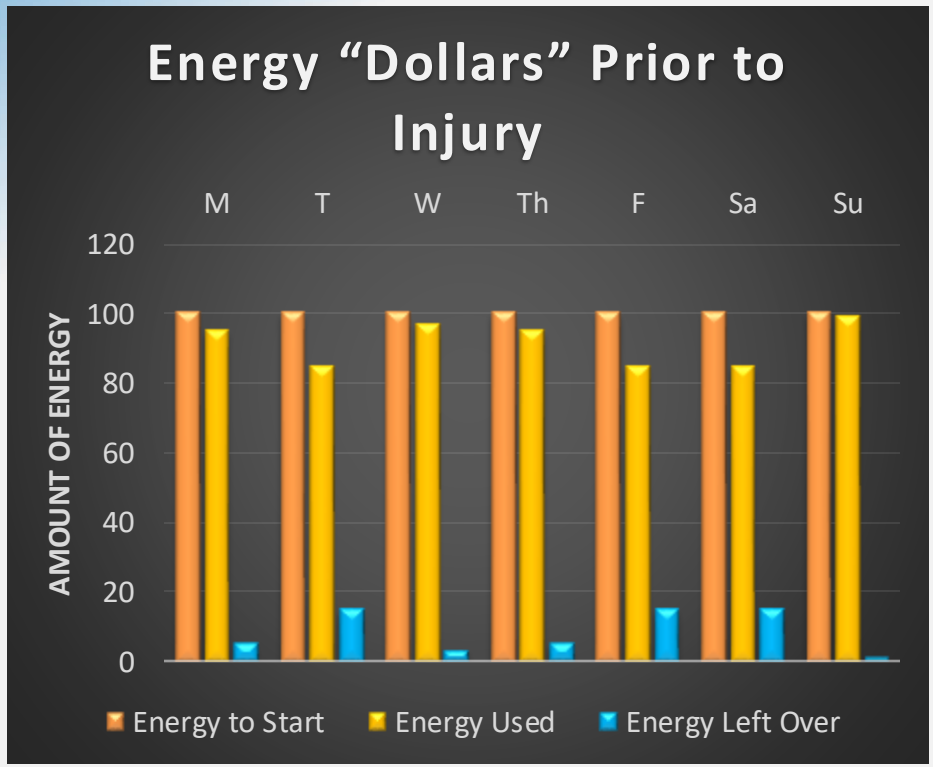


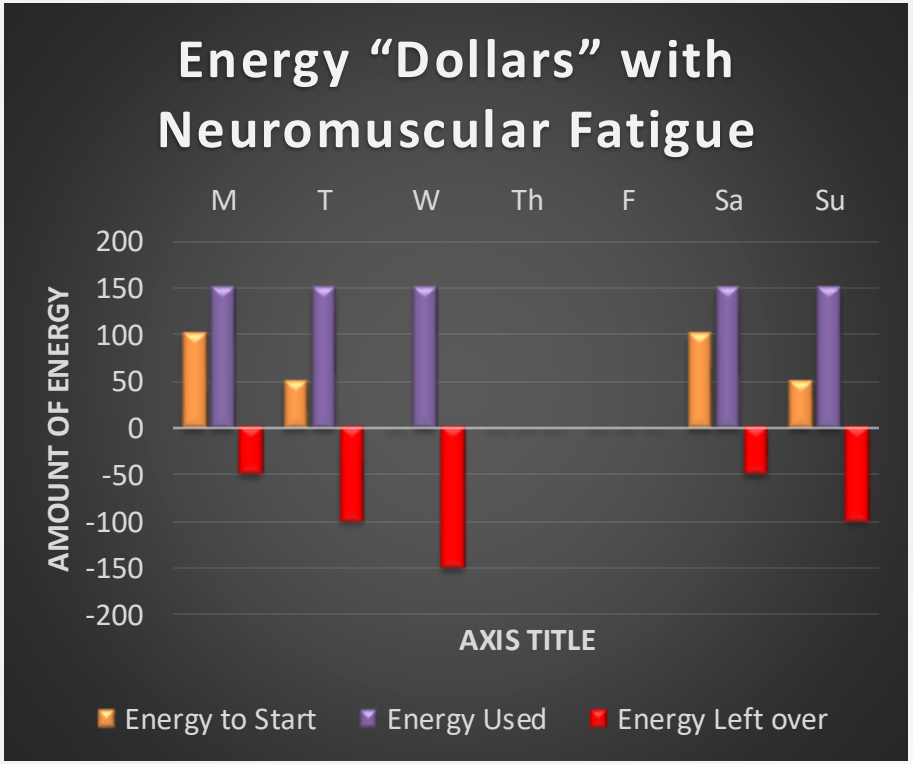
PLAN &
PRIORITIZE

THRIVE
PROGRAM



THRIVE PROGRAM





PACE

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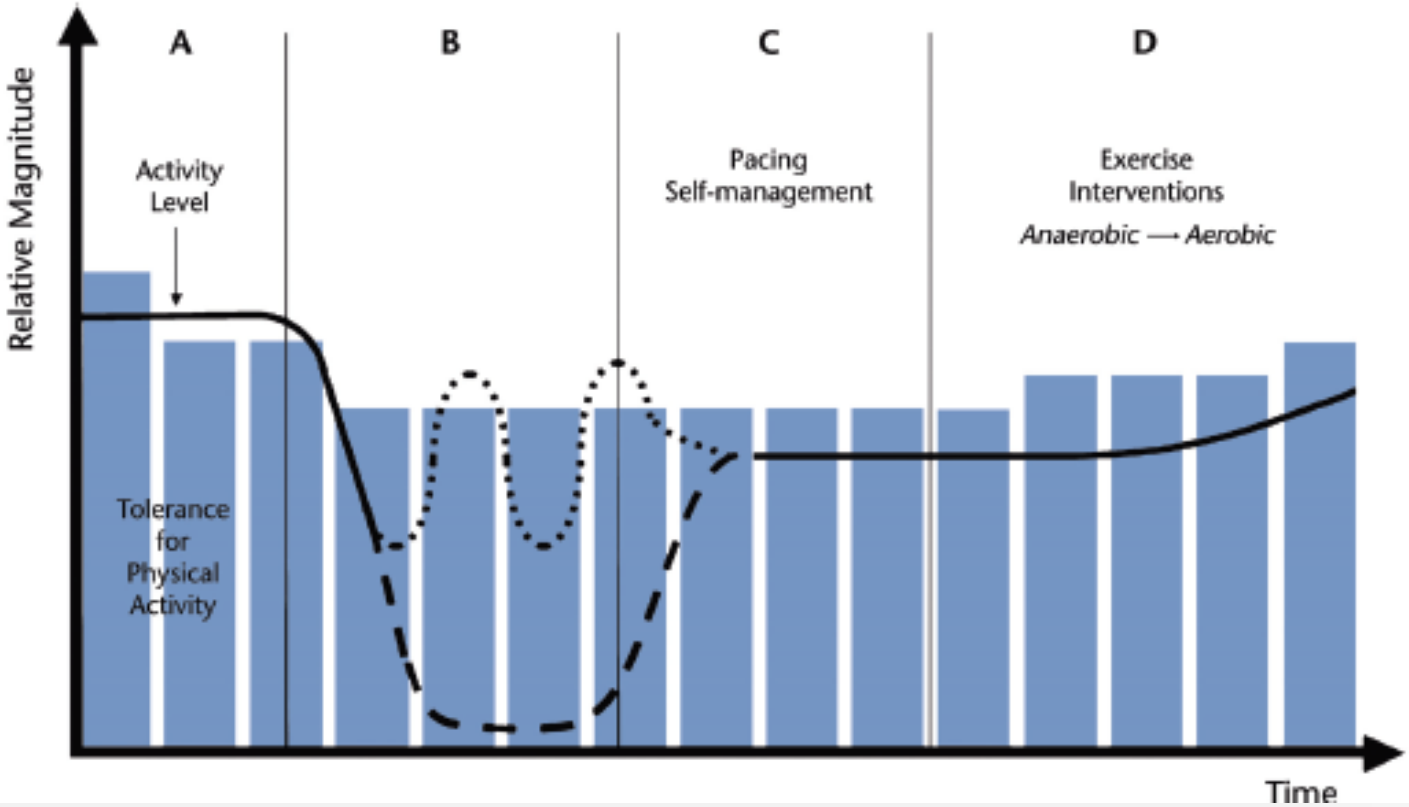
AMOUNT OF ENERGY



COMMUNICATE

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Neuromuscular fatigue: does not improve with mental toughness
Therapeutic rest: Frequent short breaks in a low-stimulation environment can enhance endurance over time.
Symptom barometer: Establish a symptom tracking system with family and a plan for managing fatigue.
Resting is needed if symptoms increase more than 2 points above baseline.

GROUND

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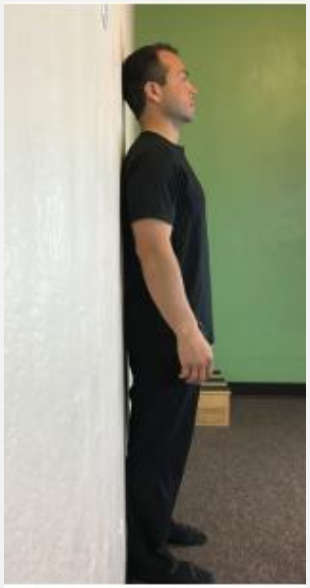
Grounding: Helps reduce dizziness, lightheadedness, or discomfort.
How it works: moving throughout static head positions while keeping the body still.
Eye position: Open (focused on a target) or closed.



Clinical Indications

Patients with VVP may not report dizziness

Traditional VRT is contraindicated for VVP

Treatment:
VVP Paradigm

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"Traditional" Sensory Re-integration

Treatment:
VVP Paradigm

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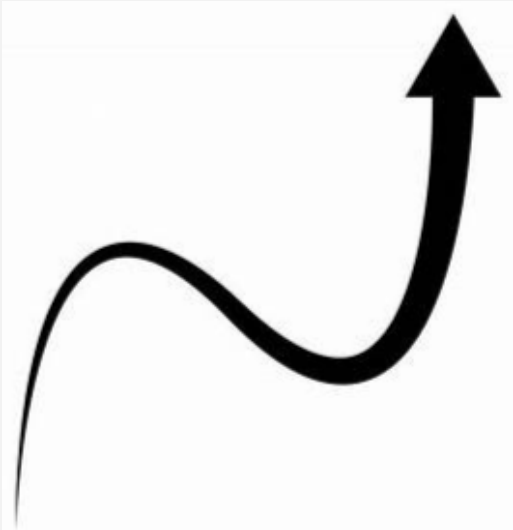
For Visual Vestibular Phenotype



Treatment:
VVP Paradigm

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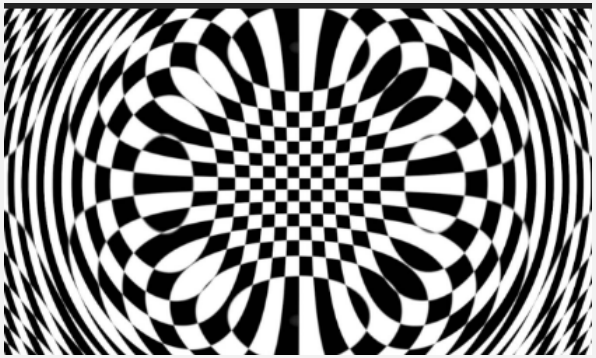
For Visual Vestibular Phenotype



Treatment:
Gaze Stabilization

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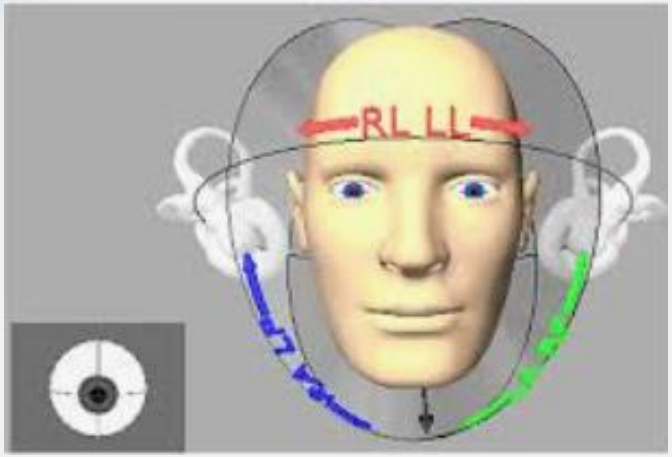

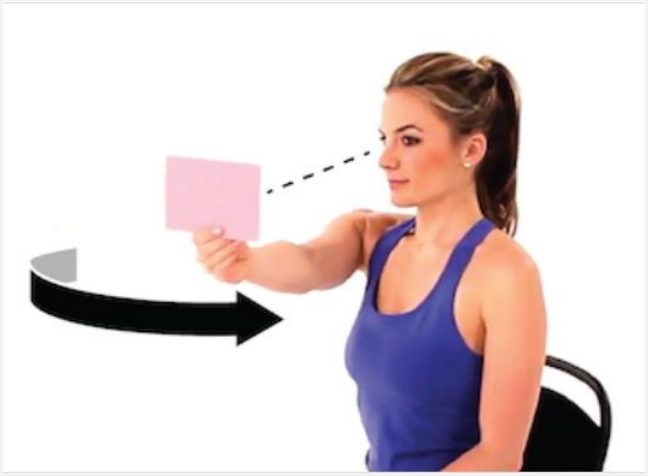

Clinical Pearls and Final Takeaways

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Survivors

Give yourself grace

Stay in-tune with your baseline

Clinicians

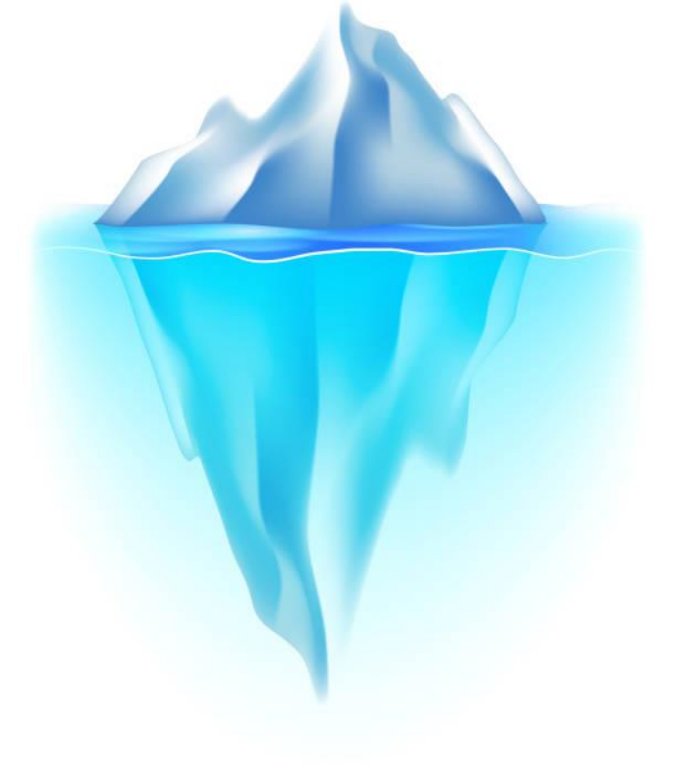
Treat the patient

Dizziness ≠ Vertigo

PTS vs. sensory dysfunction

Premature discharge

Future Directions

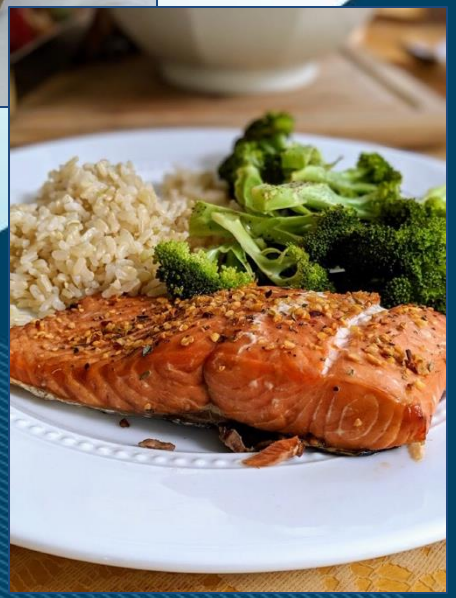


←Current data

←Expand our data
←Clarify clinical profiles
←Effective screening
←Treatment precision
←Follow outcomes

UNC Health

LOW OMEGA-6, HIGH OMEGA-3 DIETARY INTERVENTION



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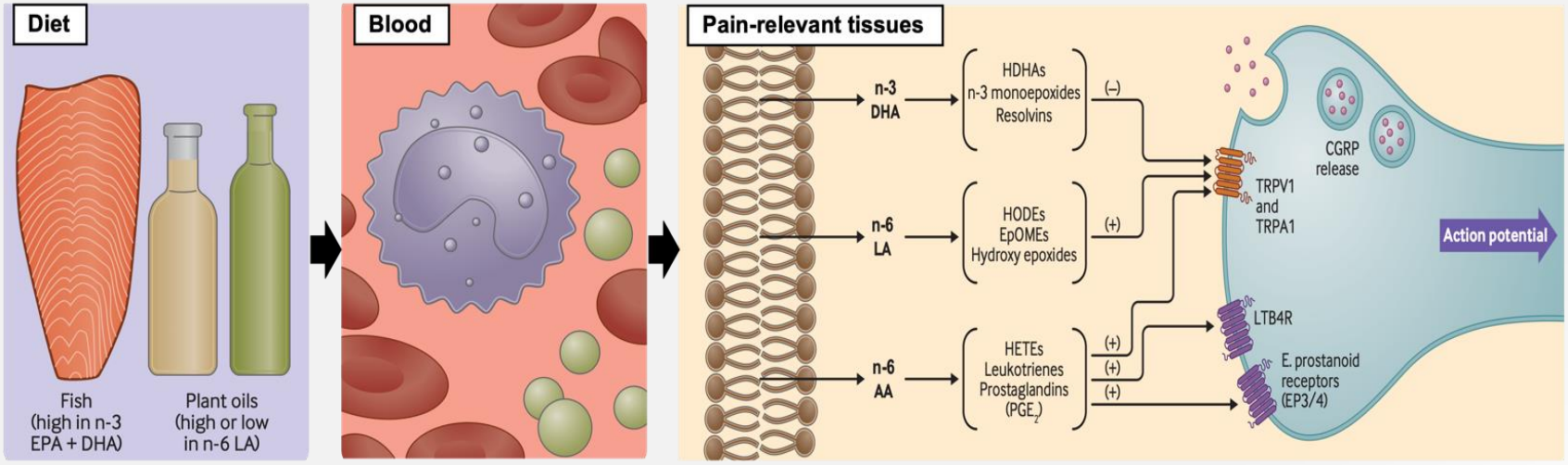
Background

Post-traumatic headache is common after TBI

Migraine-like headache accounts for 50-60% of PTH

Many with PTH do not fully respond to medications

Proposed biochemical model: from diet to pain signaling



Study Methods

Design: 12-week trial @ 3 different sites

Participants: n=122 being treated for persistent PTH with migraine features

(8+ headaches/month for 3+ months)

Interventions: H3L6 diet vs Control diet

All participants received foods to cover 2/3 of their caloric intake.

Endpoints: Headache impact on quality of life, headache intensity and frequency, and blood fatty acids levels and bioactive metabolites

Secondary Endpoints: Symptom reports, Cognitive functioning

Study Overview

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Design:

12-week RCT

122 patients with PTH

H3L6 Diet Vs Control

Endpoints:

Headache QOL HA Frequency & Intensity

Fatty acids and Bioactive metabolites

Secondary Endpoints:

Postconcussive Symptoms

Cognitive Functioning

Contents lists available at ScienceDirect

Contemporary Clinical Trials

journal homepage: www.elsevier.com/locate/conclintrial

Targeted dietary interventions to reduce pain in persistent post-traumatic headache among service members: Protocol for a randomized, controlled parallel-group trial☆

Keturah R. Faurot [a,*], Wesley R. Cole [b,u], Beth A. MacIntosh [c], Margaret Dunlap [d,e,f,1], Carol B. Moore [d,1], Brittney Roberson [g,h,1], Melissa Guerra [t], Anthony F. Domenichiello [j], Olafur Palsson [k], Wanda Rivera [f,i,l,1], Ann Nothwehr [e], Jacques Arrieux [b,1], Katie Russell [m], Cecily Jones [n], J. Kent Werner [d], Ruth Clark [d,e,1], Ramon Diaz-Arrastia [o], Chirayath Suchindran [p], J. Douglas Mann [q], Christopher E. Ramsden [r,s], Kimbra Kenney [d,e]

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ARTICLE INFO

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Traumatic brain injury
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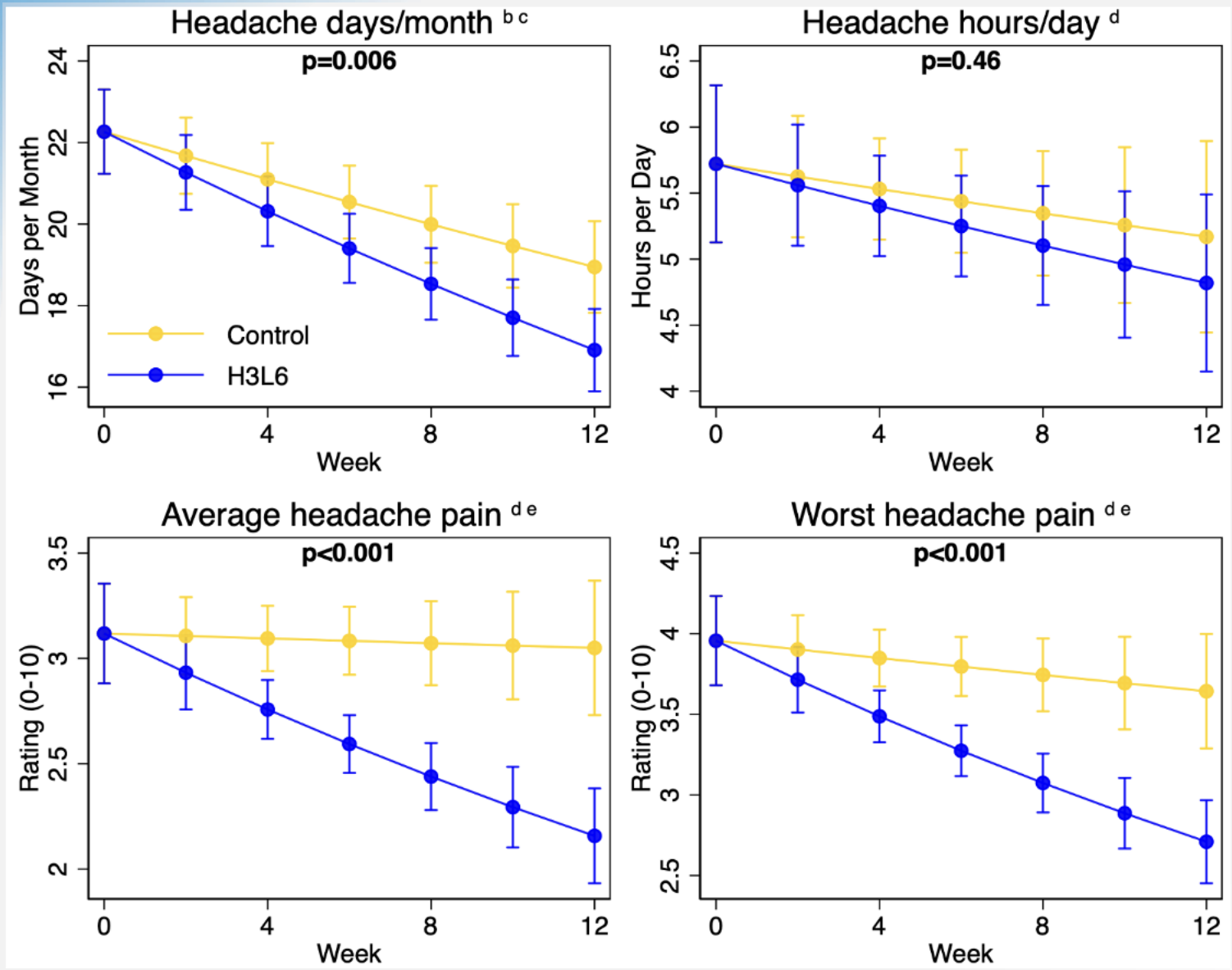
Omega-6 fatty acid

ABSTRACT

Introduction: Post-traumatic headache (PTH) is common after traumatic brain injury (TBI), especially among active-duty service members (SMs), affecting up to 35% of patients with chronic TBI. Persistent PTH is disabling and frequently unresponsive to treatment and is often migrainous. Here, we describe a trial assessing whether dietary modifications to increase n-3 eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) and reduce n-6 linoleic acid (LA), will alter nociceptive lipid mediators and result in clinical improvements in persistent PTH.

Results


Headache days/month b c
p=0.006
Days per Month
16
18
20
22
24
Control
H3L6
0
4
8
12
Week
Headache hours/day d
p=0.46
Hours per Day
4
4.5
5
5.5
6
6.5
0
4
8
12
Week
Average headache pain d e
p<0.001
Rating (0-10)
2
2.5
3
3.5
0
4
8
12
Week
Worst headache pain d e
p<0.001
Rating (0-10)
2.5
3
3.5
4
4.5
0
4
8
12
Week

Results (cont.)

Plasma 4-HDHA was increased

Decreased self-report post-concussion symptoms

However…
No impact on headache quality of life

No impact on other symptoms or cognitive testing

Summary

The H3L6 diet significantly reduced 3 clinically significant elements of headache pain

The diet modulated a key biological mediator implicated in headache pathogenesis

You're smart to eat a H3L6 diet after concussion, but eating the diet won't make you smarter

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journal homepage: http://www.elsevier.com/locate/clnu

Original article

Methodology for altering omega-3 EPA+DHA and omega-6 linoleic acid as controlled variables in a dietary trial

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n-3
Linoleic acid
Polyunsaturated fatty acids
Migraine headache

SUMMARY

Background & aims: Increasing dietary intake of n-3 EPA+DHA and lowering dietary n-6 LA is under investigation as a therapeutic diet for improving chronic pain syndromes as well as other health outcomes. Herein we describe the diet methodology used to modulate intake of n-3 and n-6 PUFA in a free living migraine headache population and report on nutrient intake, BMI and diet acceptability achieved at week 16 of the intensive diet intervention and week 22 follow-up time-point.

Methods: A total of 178 participants were randomized and began one of three diet interventions: 1) a high n-3 PUFA, average n-6 PUFA (H3) diet targeting 1500 mg EPA+DHA/day and 7% of energy (en%) from n-6 linoleic acid (LA), 2) a high-n-3 PUFA, low-n-6 PUFA (H3L6) targeting 1500 mg EPA+DHA/day and <1.8 en% n-6 LA or 3) a Control diet with typical American intakes of both EPA+DHA (<150 mg/day) and 7 en% from n-6 LA. Methods used to achieve diet change to week 16 include diet education, diet counseling, supply of specially prepared foods, self-monitoring and access to online diet materials. Only study oils and website materials were provided for the follow-up week 16 to week 22 periods. Diet adherence was assessed by multiple 24 h recalls administered throughout the trial. Diet acceptability was assessed in a subset of participants at 4 time points by questionnaire.

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Low-*n*-6 and low-*n*-6 plus high-*n*-3 diets for use in clinical research

Beth A. MacIntosh[1,*,†], **Christopher E. Ramsden**[2,†], **Keturah R. Faurot**[3,4], **Daisy Zamora**[4], **Margaret Mangan**[5], **Joseph R. Hibbeln**[6], and **J. Douglas Mann**[7]

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Intervention Nutrient Targets

	Total Fat (en%)	MUFA (en%)	SFA (en%)	Total PUFA (en%)	LA (en%)	ALA (en%)	AA (mg)	EPA+DHA (mg)
A: H3-L6	32%	18%	11%	3%	1.8%	0.6%	150	1,500
2500 kcal	89 g	50 g	31 g	8.3 g	5 g	1.6 g		
3000 kcal	107 g	60 g	37 g	10 g	6 g	2 g		
B: control	32%	12%	11%	8%	7.2%	0.6%	150	150
2500 kcal	89 g	33 g	31 g	22 g	20 g	1.6 g		
3000 kcal	107 g	40 g	37 g	26.6 g	24 g	2 g		

LA = linoleic acid = omega-6
EPA+DHA = eicosapentaenoic acid + docosahexaenoic acid = animal based omega-3's
ALA = alpha-linolenic acid = plant source omega-3's

24hr Dietary Recall Results
Pilot study – 12 week intervention in Chronic Daily Headache Population

Table 3

Diet intervention fatty acid targets and comparison of pre-intra intervention nutrient intakes from 24 h dietary recall* (Medians and 25–75 % percenti

			Changes pre–post diet intervention										
			L6 (*n* 28)					H3-L6 (*n* 27)					Between diets
	Diet targets		Pre		Intra			Pre		Intra			Pre	Intra
Variable	L6	H3-L6	Median	25–75 %	Median	25–75 %	*P*	Median	25–75 %	Median	25–75 %	*P*	*P*	*P*
Total energy (kJ)	N/A	N/A	8355	6222, 9447	7778	59·4, 9201	0·52	7142	5761, 7866	6678	5410, 8196	0·89	0·03	0·09
Total fat (en%)	32	32	33·6	29·6, 40·1	30·4	26·8, 34·3	0·05	33·4	29·1, 36·4	30·7	27·3, 34·0	0·08	0·38	0·84
Total protein (en%)	18	18	15·7	13·8, 16·8	15·2	13·7, 17·0	0·13	16·1	13·5, 19·6	17·2	15·1, 20·0	0·25	0·62	0·01
Total SFA (en%)	13	13	10·5	9·1, 11·9	14·0	12·0, 17·2	<0·001	10·5	9·8, 11·7	12·9	9·9, 14·5	0·16	0·99	0·06
Total *trans* (en%)	<0·5	<0·5	0·9	0·7, 1·2	0·6	0·5, 0·84	0·005	1·1	0·9, 1·4	0·5	0·3, 0·7	<0·001	0·07	0·06
Total MUFA (en%)	16	14	11·8	10·1, 13·2	10·4	8·0, 12·6	0·008	12·1	11·0, 13·5	9·3	8·4, 11·4	<0·001	0·82	0·51
Total PUFA (en%)	2·5	4·5	8·1	6·4, 10·6	3·5	3·1, 4·3	<0·001	7·4	5·9, 8·5	6·0	5·1, 7·1	0·1	0·05	<0·001
LA 18 : 2 (en%)	≤2·5	≤2·5	7·4	5·7, 9·6	2·4	2·0, 2·9	<0·001	6·4	5·3, 7·4	2·5	2·2, 3·9	<0·001	0·03	0·15
ALA 18 : 3 (en%)	0·6	>1·5	0·7	0·6, 0·9	0·7	0·6, 0·9	0·96	0·6	0·5, 0·9	1·6	1·3, 2·0	<0·001	0·32	<0·001
AA 20 : 4 (mg)	60	150	106	57, 159	48†	18, 74	<0·001	110	66, 176	114†	69, 195	0·75	0·64	<0·001
EPA + DHA (mg)	125	>1000	43	25, 73	76†	19, 264	0·32	47	20, 71	1482†	374, 2558	<0·001	0·96	<0·001

L6, average-*n*-3, low-*n*-6 diet; H3-L6, high-*n*-3, low-*n*-6 diet; N/A, not applicable; en%, percentage of food energy; LA, linoleic acid; ALA, α-linolenic acid; AA, arachidonic acid.

*Between-subject and between-diet comparisons were calculated with the Wilcoxon signed-rank test and Mann–Whitney *U* test, respectively.

†Indicates that intra-intervention 24 h recall database contained fewer missing values for *n*-6 AA, EPA and DHA due to chemical analysis of relevant study foods.

24hr Dietary Recall Results
16 Week RCT in Migraine Population

Table 4
24hr dietary recall median intake data.

			Total energy (Kcal)	Total fat (en %)	Total protein (en %)	Total SFA (en %)	Total MUFA (en %)	Total PUFA (en %)	LA 18:2 (en %)	LA 18:2 (g/2000 kcal)	ALA 18:3 (en %)	ALA 18:3 (g/2000 kcal)	AA 20:4 (mg/2000 kcal)	EPA (mg/2000 kcal)	DHA (mg/2000 kcal)	EPA + DHA (mg/2000)
Control	**W0**	**Median**	1569	34.5	17.0	11.5	11.9	7.4	6.5	14.4	0.8	1.8	134	16	40	60
		IQR	(1261–1967)	(30.7–38.8)	(14.7–19.1)	(9.6–13.7)	(10.5–13.6)	(6.1–9.5)	(5.5–9.0)	(12.2–20.0)	(0.6–1.1)	(1.3–2.4)	(83–192)	[8–26]	(23–81)	(34–111)
	W16	**Median**	1720	29.9	17.9	7.8	10.5	7.8	6.8	15.1	0.9	2.0	109	23	55	80
		IQR	(1240–2099)	(24.1–35.9)	(14.2–22.7)	(6.4–10.3)	(8.8–13.2)	(6.2–10.4)	(5.1–9.5)	(11.3–21.1)	(0.7–1.0)	(1.5–2.2)	(49–169)	[8–35]	(22–139)	(29–174)
	W22	**Median**	1567	30.1	18.5	9.2	10.1	7.6	7.2	16	0.8	1.8	137	20	53	74
		IQR	(1245–1888)	(25.0–34.5)	(15.9–21.9)	(6.0–10.6)	(8.0–12.6)	(5.2–11.1)	(4.7–9.6)	(10.4–21.3)	(0.6–1.1)	(1.3–2.4)	(85–215)	[13–33]	(24–104)	(37–137)
	Control-WK16 change (p-value)								0.3 (0.9918)[a]	0.7	0.1 (0.9591)[a]	0.2				20 (0.6225)[a]
H3	**W0**	**Median**	1603	34.7	15.7	11.4	12.2	7.0	6.5	14.4	0.7	1.6	122	11	36	48
		IQR	(1232–1955)	(28.7–39.1)	(12.6–18.6)	(8.4–13.4)	(10.5–13.4)	(5.0–9.1)	(4.5–8.3)	(10.0–18.4)	(0.5–0.9)	(1.1–2.0)	(80–195)	[6–16]	(20–54)	(27–77)
	W16	**Median**	1652	34.2	18.9	10.0	11.6	8.8	7.1	15.8	0.9	2.0	83	380	1063	1484
		IQR	(1360–2093)	(28.0–40.3)	(15.5–20.8)	(8.6–13.0)	(9.2–14.0)	(7.2–10.7)	(5.5–8.5)	(12.2–20.0)	(0.7–1.1)	(1.5–2.4)	(41–161)	(218–614)	(599–1747)	(804–2367)
	W22	**Median**	1471	34.3	17.9	10.2	11.3	8.2	6.9	15.3	0.7	1.6	124	250	632	861
		IQR	(1073–1838)	(28.5–38.0)	(14.4–22.1)	(7.7–13.3)	(8.8–13.6)	(6.8–10.5)	(5.5–9.0)	(12.2–20.0)	(0.6–0.9)	(1.3–2.0)	(77–223)	(20–511)	(50–1071)	(70–1662)
	H3-WK16 change (p-value)								0.6 (0.3777)[a]	1.3	0.2 (0.0159)[c]	0.4				1436 (0.0000)[b]
H3L6	**W0**	**Median**	1568	35.2	17.8	11.3	12.3	7.0	6.3	14.0	0.7	1.6	164	13	36	44
		IQR	(1193–1841)	(30.1–40.2)	(14.8–21.2)	(9.9–13.0)	(10.1–14.4)	(5.3–9.2)	(4.7–8.3)	(10.4–18.4)	(0.5–1.0)	(1.1–2.2)	(100–237)	[6–26]	(13–78)	(20–96)
	W16	**Median**	1494	34.7	18.5	11.6	13.1	5.4	3.2	7.1	1.1	2.4	130	371	964	1341
		IQR	(1137–1884)	(29.6–40.9)	(15.8–23.2)	8.8–13.7	(11.1–18.8)	(4.4–6.5)	(2.7–4.4)	(6.0–9.8)	(0.8–1.2)	(1.8–2.7)	79–190	211–744	530–1482	778–2216
	W22	**Median**	1472	33.0	18.6	12.3	12.5	5.3	3.6	8	0.8	1.8	170	296	722	1052
		IQR	(1172–1734)	(28.5–39.8)	(15.3–21.4)	(8.7–14.4)	(8.8–17.6)	(4.0–7.0)	(2.9–4.9)	(6.4–10.9)	(0.6–1.3)	(1.3–2.9)	(90–260)	(43–506)	(110–1212)	(149–1785)
	H3L6-WK16 change (p-value)								−3.1 (0.0000)[b]	−6.9	0.4 (0.0040)[c]	0.9				1297 (0.0000)[b]
	WK16 H3 vs Control (p-value)								1.0		0.6					<0.0001
	WK16 H3L6 vs Control (p-value)								<0.0001		0.01[c]					<0.0001
	WK16 H3 vs H3L6 (p-value)								<0.0001		0.1					1.0

[a] Achieved nutrient target.
[b] Achieved nutrient target but not to level planned.
[c] Change occurred when maintenance was nutrient target.

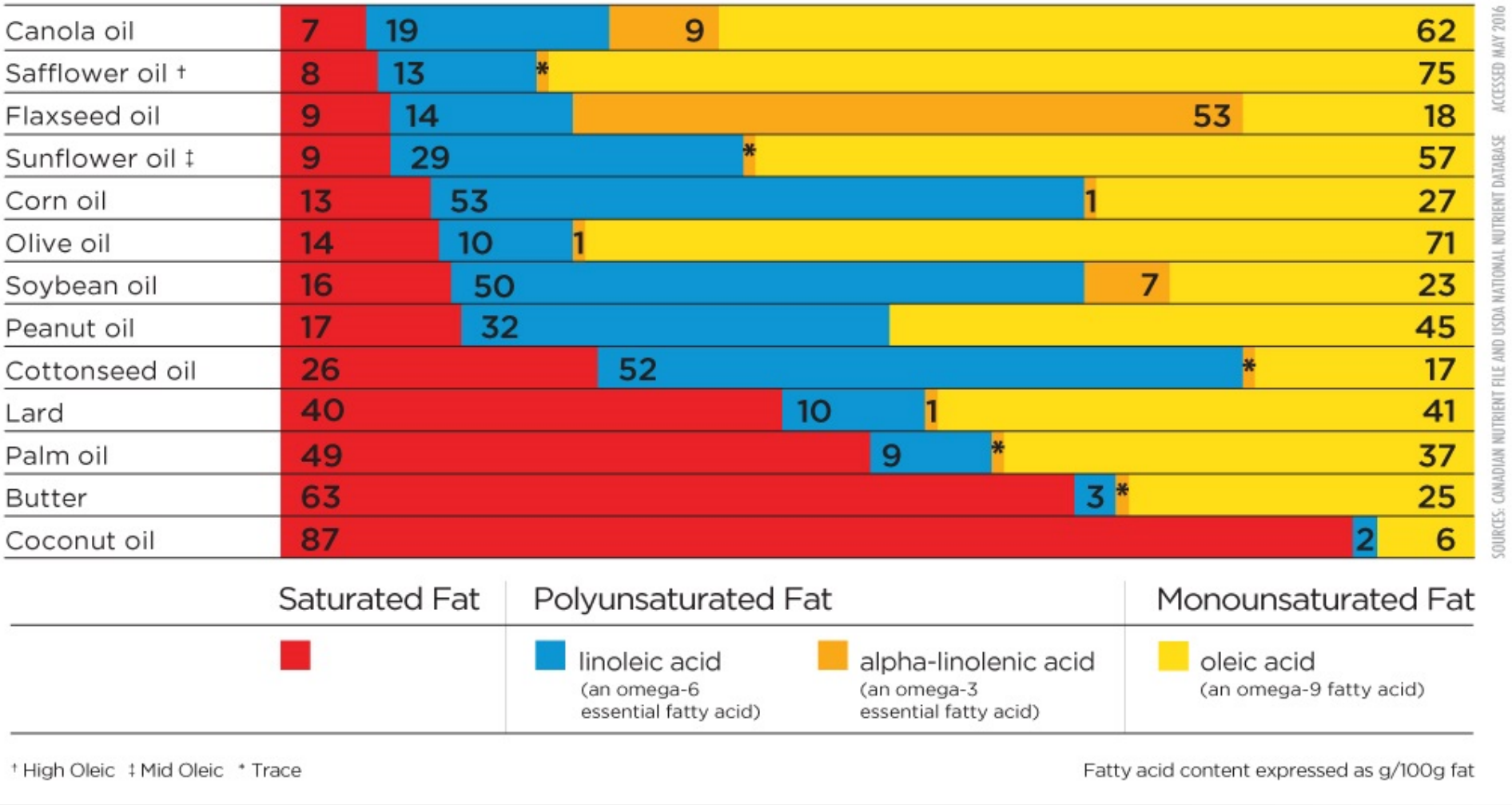
Study Protocol – Diet Intervention Methods

1. Provision of key foods (fish, oils, snacks, low n-6 foods) on bi-weekly basis
2. Bi-weekly nutrition counseling
3. Self-monitoring (diet checklist and daily rating of adherence)
4. Diet education materials designed to address all places people make food choices: Diet Guidelines, Food List, Grocery Shopping Guides, Reading Food Labels activity, Dining Out Guide, 7-day Meal Plan, 75+ diet adherence recipes, Cooking Guide, Travel Guide
5. Access to mobile friendly website with all diet education materials

Diet Guidelines

Increase Omega-3	Lower Omega-6
• Consume 1, 4oz serving of high fat fish per day. This included salmon, albacore tuna and sablefish. • The study provided frozen and canned fish in order to reach this goal. *Flaxseed 2 tsp to 2 Tbsp per day	• Use only the study provided oils for all home food preparation. When dining out or purchasing processed foods eliminate all oils except olive oil, coconut oil, palm oil, palm kernel oil) • Study provided oils included a blend of olive oil/macadamia nut oil as well as butter, fat free mayonnaise and a cruet for preparing salad dressing with study oil. • Eliminate fried foods and limit fast food and processed food (especially snack foods). • Include plenty of low omega-6 foods such as fruit, vegetables, minimally processed grains and dairy.

Comparison of Dietary Fats



Study Provided Oils

Oil	Data Source	LA g/100g	ALA g/100g
Extra Virgin Olive Oil (Trader Joe's)	Lab Analysis	6.8	0.698
Extra Virgin Olive Oil (Bertolli)	NDSR	9.76	0.76
Macadamia Nut Oil (Vital Choice)	Lab Analysis	2.3	0.191
Low n-6 Oil Blend	Lab Analysis	2.048	0.042
Butter, salted	USDA	2.166	0.315
Coconut oil	Lab Analysis	0.9	0.0
Low n-6 Vinaigrette	Lab Analysis	1.957	0.259
Corn Oil	Lab Analysis	50.375	1.043
Soybean Oil	USDA	50.95	6.79
High n-6 Oil Blend	Lab Analysis	45.408	0.892
High n-6 Butter Blend	Lab Analysis	29.632	0.629
High n-6 Vinaigrette	Lab Analysis	15.851	0.456

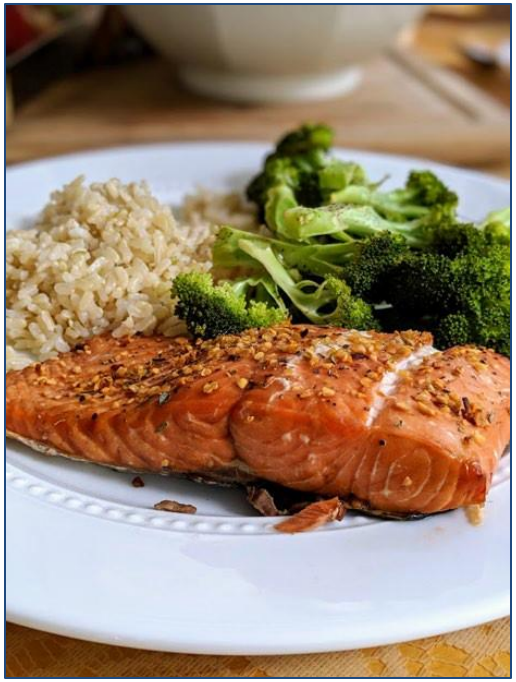
Fats and Nuts

Fats allowed	Fats to choose when dining out or reading ingredient lists	Fats to avoid
Study provided oil Study provided butter Salad dressing made with study provided oil Study provided salad dressing Fat-free mayonnaise Fat-free salad dressings	Extra virgin olive oil Butter Coconut oil Palm kernel oil Palm oil	Margarine – Stick or tub Vegetable oil Avocado oil Canola oil Corn oil Cottonseed oil Low fat mayonnaise Soybean oil Safflower oil Sunflower oil Sesame oil Peanut oil Rice Bran oil Salad dressing Mayonnaise Grapeseed Partially hydrogenated vegetable oil Mono- and Diglycerides Vegetable dips
Nuts and seeds allowed	**Nuts and seeds to limit**	**Nuts and seeds to avoid**
Macadamia nuts	Cashews Hazelnuts Almonds Almond butter	Walnuts Brazil nuts Peanuts Peanut Butter Mixed nuts Pecans Pine nuts Pistachios Sesame seeds Tahini paste Sunflower seeds

EPA+DHA Food Sources

Food (Brand)	Data Source	LA g/100g	EPA+DHA mg/100g
Wild Sockeye Salmon (Vital Choice)	Lab Analysis	0.3	2,500
Wild Sockeye Salmon (Whole Foods)	Lab Analysis	0.010	455-568
Albacore Tuna (Vital Choice)	Lab Analysis	0.128	3,800
Canned - Pacific Sockeye Salmon (Vital Choice)	Lab Analysis	0.099	1,331
Canned – Albacore Tuna (Vital Choice)	Lab Analysis	0.156	4,908
Sablefish (Vital Choice)	Lab Analysis	0.3	1,800
Trout (Trident Foods)	Lab Analysis	0.225	792
Sardines (Brunswick)	Lab Analysis	0.115	1,591-2,150
Chicken Breast (Tyson)	USDA	0.59	30
Ground Turkey (Shady Brook)	USDA	0.66	10
Cod (Trident)	Lab Analysis	0.007	169-255
Chunk Light Tuna (Harris Teeter)	Lab Analysis	0.004	144
Shrimp (Whole Foods)	Lab Analysis	0.013	78
Tilapia (Krimson Premium Seafood)	Lab Analysis	.2	30

Fish



Beef, poultry, fish, and pork Allowed	Beef, poultry, fish and pork to limit	Beef, poultry, fish and pork to avoid
Best Choices:	Catfish (also called Swai or	Fried fish
Wild Salmon – Alaskan or Pacific	Pangasius)	Fried Squid/Calimari
Wild Mackerel	Tilapia	Fried chicken
Wild Turbot	Orange Roughy	**Processed meats:**
Tuna	Beef	Bacon
Swordfish	Chicken	Ham
Halibut	Turkey	Pepperoni
Bluefish	Pork	Salami
Trout	Duck	Sausage – all kinds
Sea Bass	Lamb	Bologna
Whitefish	Venison	Hot dogs
Herring		Deli meat
Perch		Liverwurst
Canned Salmon		Spam
Oysters		
Arctic Char		
Barramundi		
Good Choices:		
Canned Tuna		
Scallops Shrimp		
Crabs		
Oysters		
Mussels		
Clams		
Crayfish		
Squid/Calimari		
Lobster Grouper		
Atlantic Salmon		
Cod		
Snapper		
Flounder		
Haddock		

Snack Foods

Salty snacks allowed	Salty snacks to limit	Salty snacks to avoid
Popcorn (no oil added or with Palm oil only) Fat free pretzels Low fat crackers – study provided Wasa crackers Jerky – study provided		Crackers Potato chips Tortilla chips Packaged snack foods Packaged cakes

Sweets allowed	Sweets to limit	Sweets to avoid
Fruit – fresh Fruit – dried Fruit - frozen Real Whip cream Pudding – homemade Jell-o Smoothies Ice Cream – vanilla, chocolate or strawberry flavor (no nuts or chocolate pieces) Dark chocolate Homemade cake – study recipe Homemade fruit pie – study recipe Sugar Chewing gum Popsicles Italian ice	Fat free hard candies	Cake – store bought Pies – store bought Frosting – store bought Cookies – store bought Candy Bars Cool Whip Graham Crackers Cake mix Brownie mix Prepared pudding and pudding mixes Ice cream cones

Condiments

Condiments allowed	Condiments to limit	Condiments to avoid
Red Wine Vinegar		Chip dips
Balsamic Vinegar		Mayonnaise
Cider Vinegar		Bacon bits
Rice Vinegar		Gravy
Lemon juice		Most salad dressings
Ketchup		
Mustard		
BBQ sauce		
Cocktail sauce – brands without oil		
Salsa		
Hot Sauce		
A-1 Sauce		
Worcestershire sauce		
Soy sauce		
Relish		
Pickles		
Olives		
Jelly		
Jam		
Syrup		
Honey		
Fat free mayonnaise		

Dairy, Fruits, Vegetables, Whole Grains, Beans, Herbs and Spices

Reading Food Labels

Nutrition Facts

Serving Size 1 OZ
Servings Per Container 8

Amount Per Serving

Calories 140	Calories from Fat 60
	% Daily Value*
Total Fat 8g	13%
Saturated Fat 1.5g	8%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 250mg	10%
Total Carbohydrate 18g	6%
Dietary Fiber 1g	2%
Sugars 0g	
Protein 1g	

Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 0%

Percent daily value reflects "as packaged" food.

* Percent daily values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 Carbohydrate 4 Protein 4

INGREDIENTS: Whole Potato Flour, Expeller Pressed Sunflower, Safflower and/or Soybean Oil, Tomato Puree, Spinach Puree, Garlic, Sea Salt.

Practical Diet Recommendations

1. Use olive oil, butter and coconut oil in all home food preparation with focus on good quality extra virgin olive oil.

2. Limit foods high in vegetable oils like fried foods, chips, crackers, mayonnaise and store-bought salad dressings. Start reading ingredient lists carefully.

3. Increase intake of fatty fish to at 4-5 times per week. Choose fish high in omega-3's like salmon and albacore tuna. Canned fish like sardines, canned tuna and canned salmon are great options and affordable.

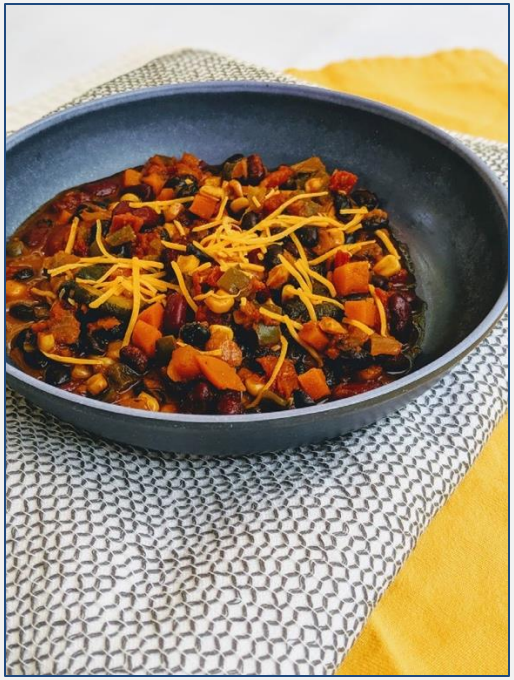
4. Incorporate plant sources of omega-3's into your routine as well – ground flaxseed and chia seeds.

5. Base your diet on foods that are naturally low in omega-6 fatty acids – minimally processed grains, fruits, vegetables, grass fed meats and pasture raised eggs, low sugar dairy products, beans.

7-DAY MEAL PLAN

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Breakfast	*1 Flaxseed Granola Bar* Fruit, 1 Cup Milk or *Yogurt*	1 Serving Smoothie, 1 ½ Cup Cheerios with 1 Cup Milk	1 ½ Cups cooked Oatmeal with Honey, Dried Coconut, 2 tsp *Flaxseed*, 1 Cup Fruit, 1 Cup Milk or *Yogurt*	Bagel with Cream Cheese, 1 Cup *Yogurt* or Milk, Fruit	Parfait: ¾ Cup *Macadamia Nut Granola*, ¾ Cup *Yogurt* and ½ Cup Fruit	3 Apple Flaxseed Pancakes, 2 Tbsp Maple Syrup, 2 tsp *Study Butter*, 1 Cup Milk or *Yogurt*	Scrambled Eggs with Cheese, *Toast* (study bread) with *Study Butter*, Smoothie
Lunch	2 Salmon Cakes, Green Salad with *Balsamic Vinaigrette*, ½ Cup Warm Potato Salad	1 Serving Spinach Salad with *Shrimp*	2 Rice, Bean and Vegetable Fajitas	1 *Tuna* Salad Sandwich, Cucumber and Tomatoes with *Balsamic Vinaigrette*, Fruit	1 ½ cups Salmon Macaroni Salad and Green Vegetable Salad with 3 Tbsp *Vinaigrette* and Cheese	2 Cups *Tuna* Noodle Casserole and 1 Cup Mixed Vegetables cooked with *Study Oil*	4 oz Broiled *Sablefish with Study Seasoning*, Roasted Asparagus, Rice
Sides and Snacks	Fruit, 1 *Cheese Stick,* Baby Carrots with Ranch Dressing	Fruit, 1 *Study Brownie*	Fruit, Celery Sticks with Creamy Blue Cheese Dressing, *1 Cheese Stick, Beef Jerky*	*Popcorn,* Fruit with *Yogurt*	*1 Granola Bar, Beef Jerky,* Fruit	*Beef Jerky*, Fruit, *Cheese Stick*	Fruit, 2 oz Sardines with *Study Crackers,* Cucumber Slices with Light Ranch Dressing
Dinner	*Veggie Patty* on *Study Bread* with Cheese, Onion, Tomato and Lettuce. Tomato Soup and *Study Crackers*	6 oz *Salmon* with Maple Glaze, 1 ½ Cup Broccoli Salad, 1 Cup Rice Pilaf	*Tuna* and Potato Croquettes, 1 Cup Green Beans cooked with 1 ½ tsp *Study Oil*, 1 ½ Cups Sweet Potato Fries	Grilled Steak, 1 ½ Cups Thyme Roasted Vegetables	2 Grilled *Fish* Tacos	1 ½ cups *Shrimp* and Orzo, Mixed Greens Vegetable Salad with 2 Tbsp Vinaigrette	1 ½ Cups *Vegetarian Chili* with 1 Baked Potato and Sour Cream
Desserts	½ Cup Blueberry Crisp with ½ Cup Vanilla Ice Cream	¾ Cup Vanilla Ice Cream, 1/4 Cup *Macadamia Nut Granola*	*Study Brownie* with Milk	*Flaxseed Granola Bar*	1 Baked Apple with Macadamia Nuts and Raisin Filling	1 Fruit Popsicle	2 Slices Banana Bread



Thank You

Questions?

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