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Brief Report

Acupuncture Effects on COVID -19 Long- Hauler Syndrome

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Abstract

Purpose: Evaluate acupuncture effects in patient reported outcomes among adults experiencing long-hauler syndrome post COVID-19, specifically, taste and/or smell loss or alterations and cognitive dysfunction or "brain fog".

Background: In the wake of the COVID-19 outbreak, a new sequelae of symptoms arose which has been coined as "long- hauler syndrome", classified by one or more of the following: fatigue, dysgeusia, anosmia, pain, cognitive dysfunction or "brain fog". These symptoms have been reported regardless of the severity of the COVID-19 infection.Though Acupuncture dates back thousands of years, recent research has been revealing the neurological effects within the brain, supporting the potential effectiveness of acupuncture for treating the symptoms associated with long- hauler syndrome. Acupuncture is a therapeutic method used in Traditional Chinese Medicine (TCM) and is based on the idea that energy "Qi" flows along meridians where acupuncture points are located in the body. It is believed that illnesses and symptoms appear when the flow of Qi is disrupted and becomes unbalanced.

Methods: Prospective, cohort pilot study of 20 patients, the majority not having any other medical condition except complaints of COVID-19 long- hauler syndrome. All subjects received the following Acupuncture protocol: 6 treatments (2 per week) to 9 points GB20, LI20, LI4, K3, Shen Men on the ear, LV3, ST36, DU20, Yin Tang. At three different intervals (baseline, post session 3, post session 6), subjects completed three tests: 1) PROMIS® scale questionnaire rating their brain fog 2) ability to taste through Taste Test Strip consisting of control strip (untreated), PTC (phenylthiocarbamide- bitter), thiourea and sodium benzoate to determine recognition of bitter, and salty. Subjects rated how strong the taste was on a scale of 1-10, and what they tasted with 7 choices to choose from. 3) ability to smell through the UPSIT Test, an 8 item "scratch and sniff" test, each with 4 choices for answers. Repeated measures of variance were performed using a statistical package for social services, version 26.

Results: The 20 patients comprised of 4 male, 16 female, mean age 49, (range 28-70), 50% had never had acupuncture in the past. 45% had been diagnosed with COVID-19 less than 6 months prior, 30% 6-12 months prior, 25% more than one year prior. Symptoms and treatment reported during Covid illness were: 70% respiratory, 60% GI, 85% chills/general malaise, 95% nervous system disorders (brain fog, altered taste, altered smell). 35% took OTC medications, 20% had no treatment, 20% required medical care, no-one required oxygen. 95% reported no pain.

Targeted acupuncture protocol of 6 treatments revealed statistically significantly improved brain fog (p=0.002), smell (p=0.000), taste (p=0.000) (T-Test RM ANOVA). We found the targeted acupuncture protocol had statistically significant improved smell (p= 0.001) and taste (p=0.002) after the third treatment.

Conclusion: This study provides a foundation for future acupuncture research for COVID-19 long-hauler syndrome for the symptoms of dysgeusia, anosmia, and brain fog. Dissemination of information on acupuncture's efficacy is needed.

Keywords: Anosmia; Brain fog; COVID-19; Dysgeusia, Long hauler syndrome

Introduction

On March 11, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic [1]. In 2021, researchers and clinicians found that some patients experience neurologic, pulmonary, cardiac, and gastrointestinal dysfunction post-acute phase constituting a long COVID syndrome formally referred as "post-acute sequelae of SARS-CoV-2 infection" [PASC], [2]. Experts have seen some patients develop persistent and debilitating symptoms despite a relatively mild illness commonly referred to as "long- hauler syndrome" [2]. It is hypothesized by Baig, that the continued neurologic effects post COVID infection may be from continued inflammatory response, or degenerative neuron or glial cells [3]. Of particular interest, this study aimed to determine if a specific acupuncture prescription would improve symptoms of dysgeusia, anosmia and brain fog.

Acupuncture has emerged as a possible treatment for PASC. According to Wen and colleagues (2020), acupuncture, originally founded in China, relies on the traditional Chinese Medicine theory that describes the state of health as a balance of energy within the body [4]. More specifically, it involves the insertion of fine needles into different parts of the body to correct the imbalance of energy within the body [4,5]. Following an NIH Consensus Development Conference on Acupuncture in 1997, the WHO drafted evidence-based acupuncture and history of acupuncture research moxibustion clinical practice guidelines covering five diseases or symptoms: depression, migraine, Bell's palsy, herpes zoster, and dysphagia after stroke [6]. Zhuang et al. described a multitude of acupuncture clinical trials that have shown neurotransmitter effects on the brain [5]. Li and Wang supported this evidence citing that acupuncture stimulates nervous

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system activity in specific regions of the brain, allowing for the release of neurochemicals and enhancing cerebral microcirculation [7]. The evidence supports using acupuncture as a treatment for PASC in relation to the above mentioned dependent variables. Acupuncture is an individualized system of therapy, however, it was hypothesized that a specific 9 point treatment plan could be used with success for the treatment plan used in this study. We hypothesized that our study would support this.

Vent and colleagues (2010) studied fifteen patients with post viral olfactory dysfunction, and found acupuncture significantly improved (p=0.02) the sense of smell compared to those participants that were treated with vitamin B complex [8]. The acupuncture regimen included 10 weekly, 30-minute sessions involving these points: GV16 (Fengfu), GV20 (Baihui), LI20 (Yingxiang), LU7 (Lieque), LU9 (Taiyuang), ST36 (Zusanli) and KD3 (Taixi) [8]. In a larger randomized control trial, by Dai, Pang and Yu (2015), of fifty patients (n=25 acupuncture and n=25- control group) with post viral olfactory dysfunction, patients in the acupuncture significantly improved their sense of smell. The acupuncture regimen included these pressure points: yingxiang, shangyingxiang and biqiu. Researchers administered the regimen three times a week for a total of ten times.) [9]. Clearly, evidence supports acupuncture for post-viral olfactory dysfunction, but a gap remains if acupuncture will improve the sense of smell in patients with PASC.

Dysgeusia is a condition where a person's perception of taste is altered. Taste is known through nerve receptors, particularly the trigeminal nerve, cranial nerve #5 [10]. The five basic tastes include: sweet, salty, sour, bitter and umami, but recent evidence suggests that fat may also be a basic taste [10]. Anosmia and hyposmia is defined as having no smell, or a decreased ability to smell [10]. It has been seen in head trauma as well as neurodegenerative disorders, which is why these two conditions were in our exclusion criteria. Smell receptors vary from person to person and are located along a bundle of nerve fibers along the olfactory nerve. These smell receptors can be affected in their distribution due to many factors including viral or bacterial infection, head trauma, chemical exposure [11].

Lastly, brain fog is defined as a cognition impairment marked by feeling mentally slow, or having an inability to focus [2]. Baig hypothesizes that the continued neurologic effects post COVID infection may be from continued inflammatory response, or degenerative neuron or glial cells [3].

Objectives

The ACCOLADE study (Acupuncture Effects on COVID -19 Long- Hauler Syndrome) sought to understand the effects of acupuncture on long-hauler syndrome for the symptoms of dysgeusia, anosmia and brain fog using a nine-point acupuncture protocol.

Materials and Methods

The study was approved by the Institutional Review Board. Following written informed consent, participants completed a demographic form. Data was collected at three different intervals (baseline, post session 3, post session 6) with the following validated instruments.

Dysgeusia was measured using standard research Taste Test Strips which consisted of a control strip (untreated), phenylthiocarbamide (bitter), thiourea (bitter) and sodium benzoate (salty) to determine taste recognition [11]. Participants placed the taste strips on their moistened tongue and rated their taste perceptions on a scale of 1-10 with higher scores indicating higher intensity of taste perception [11]. Anosmia was measured using the UPSIT Test (8-item "scratch and sniff" test) [12]. Each participant received a new card with 8 scents (smoke, natural gas, chocolate, grape, onion, leather, strawberry and soap). Participants were asked to rate their smell perceptions on a scale of 1-10 with higher scores indicating higher intensity of smell perception [12]. Brain fog was measured with PROMIS ® Cognitive Function - Abilities – Short Form 4a. Participants self- reported their cognitive function abilities on a 5-point system ranging from 'never rarely' to 'very often,' with higher scores indicating more cognitive challenges [13].

Acupuncture protocol

All participants received the following nine acupuncture points: GB 20, LI 20, LI 4, K3, Shen Men, LV 3, ST 36, DU 20, and Yin-Tang by a Masters prepared board certified acupuncturist. Needles were manually manipulated briefly immediately after insertion and remained in place for 20 minutes. Multiple steps were taken to ensure intervention fidelity including: supine position with joints supported with pillows for comfort, soft background music and lights dimmed. Participants were encouraged to relax and breathe deeply. The acupuncturist removed, counted and discarded the needles. Participants received the same treatment (2/per week) for three weeks for 20 minutes each session. Table 3 provides the ACCOLADE acupuncture protocol.

Sample

Inclusion criteria included adults (ages 18-70 years), with a history of being diagnosed with SARS-Co-V2, at least one -long hauler syndrome symptom (i.e., dysgeusia, anosmia, brain fog), minimum of 30 days out from diagnosis to a maximum of 24 months, able to lay flat for 20 minutes and greater than one week post vaccination. Exclusion criteria included: participants unable to complete the forms independently, pregnancy, fear of needles, recent (past 30 days) extensive surgery requiring hospitalization, history of known neurodegenerative diseases (i.e., Parkinson's Disease, Myasthenia Gravis, Multiple Sclerosis, Dementia), history of recent head trauma in the past month and active skin infection.

Setting

The ACCOLADE took place at a community based hospital Center for Integrative Medicine in Connecticut.

Recruitment

Participants were recruited with flyers and through snowball sampling. Enrollment occurred from July 2021- February 2022. All participants completed the study per protocol. Basic descriptive statistics and RM-ANOVA were done. All data were analyzed with IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY.

Results

The participants (N=20) were predominantly female (80%) with a mean age of 49 (range 28-70). Most (45%) of the participants had been diagnosed with COVID-19 less than 6 months prior to the study. The majority of the participants were treated for COVID at home; 20% required medical care (hospitalization, ED, urgent care). The majority (90%) were white. Fifty percent of the participants had never

had acupuncture but 25% reported receiving acupuncture 3 or more times a year. (Table 1). At baseline, 95 % (19/20) of participants had self reported alterations in taste (dysgeusia) (M=3.10, SD=1.65), and smell (anosmia) (M=2.50, SD=1.36) and altered concentration (brain fog) (M=3.55, SD=2.61). After the last session participants experienced improved dysgeusia (M=6.15, SD=2.92) , anosmia (M=6.45, SD=2.54) and less brain fog (M=1.90, SD=1.45). (Table 2)

There was a significant main effect for anosmia (F (2, 18) = 19.93, (p=0.000) with an estimated large effect size (nP2 = .689). There was a significant main effect for dysgeusia (F (2, 18) = 15.97, p=0.000) with an estimated large effect size (nP2 = .640). There was a significant main effect for brain fog (F (2, 18) = 6.16, p=0.009) with an estimated large effect size (nP2 = .41). The protocol had statistically significantly improved dysgeusia (p=0.002) and anosmia (p=0.001) after the third treatment. (Table 2). All 20 participants completed the 9 point acupuncture protocol of 6 treatments (Table 3).

	Total (N=20)	**Percent**
Sex assigned at birth		
Male	4	20%
Female	16	80%
Race	**Total (N=20)**	**Percent**
White	18	90%
Hispanic	2	10%
Age at diagnosis		
Mean (SD)	49.25	
Minimum =28- Maximum =70		

Table 1: ACCOLADE Demographics Results.

History of Acupuncture		**Total**	**Percent**
		(N=20)	
Never		10	50%
Rarely		4	20%
Frequently		1	5%
3-4 Times a year		3	15%
More than 5 Times a year		2	10%
TIME FRAME OF DIAGNOSIS OF COVID		**Total**	**Percent**
INFECTION (N=20)		**(N=20)**	
LESS THAN 6 MONTHS		9	45%
6- 12 MONTHS		6	30%
MORE THAN ONE YEAR		5	25%
SYMPTOMS OF COVID (N=20)		**Total**	**Percent**
		(N=20)	
Respiratory Symptoms - YES		14	70%
Respiratory Symptoms - NO		6	30%
GI Symptoms [nausea, vomiting, diarrhea] -		12	60%
YES			
GI Symptoms [nausea, vomiting, diarrhea] - NO		8	40%
General Symptoms [chills, general malaise]	-	17	85%
YES			
General Symptoms [chills, general malaise]	-	3	15%
NO			
Nervous Symptoms [altered cognition, "brain		19	95%
fog", altered taste "dysgeusia", altered smell			
"anosmia" - YES			
Nervous Symptoms [altered cognition, "brain		1	5%
fog", altered taste "dysgeusia", altered smell			
"anosmia" - NO			
Skin (rash) - YES		1	5%
Skin (rash) - NO		19	95%

Table 2: Acupuncture Treatment Results.

DYSGEUSIA - TASTE (N=20)	**Mean**	**Std. Deviation**	**P Value**
(1=No Ability to Taste, 10=Taste			
Everything. The Trend went up from			
baseline to post session 6)			
Baseline	3.1	1.65	
Post Session 3	4.85	2.56	**0.002**
Post Session 6	6.15	2.92	**0.000**
Within Subject Factors:	0.639		
Partial Eta Squared Linear accu			
Statistical Test Within Subjects - Type	93.025		**0.000**
III Sum of Squares			
Statistical Test Between subjects - Type	1325.4		**0.000**
III Sum of Squares -Intercept			
Within Subject Factors: Multivariate	0.64		**0.000**
Test- Pillai's trace value = .640 (F) (2,			
18) = 15.97			
Within Subject Factors: Multivariate	0.36		**0.000**
Test- Wilks Lambda Value = .360 (F)			
(2,18) = 15.97			

Pairwise Comparison Between all	-1.750*	0.422	**0.002**
subjects baseline to post session 3			
Pairwise Comparison Between all	-3.050*	0.526	**0.000**
subjects baseline to post session 6			
ANOSMIA - SMELL (N=20)	**Mean**	**Std. Deviation**	**P Value**
Results: The Trend to smell better			
went up from baseline to post session 6			
Baseline	2.5	1.36	
Post Session 3	4.7	2.15	**0.001**
Post Session 6	6.45	2.54	**0.000**
Statistical Source accu Linear Sum of	156.025		**0.000**
Squares			
Within all 20 subjects			
Within Subject Factors:	0.689		
Partial Eta Squared Linear accu			
Statistical Test Between subjects -	1242.15		**0.000**
Type III Sum of Squares -Intercept			
Within Subject Factors: Multivariate	0.689		**0.000**
Test- Pillai's trace value = .689 (F) (2,			
18) = 19.93			
Within Subject Factors: Multivariate	0.311		**0.000**
Test- Wilks Lambda Value = .311 (F)			
(2,18) =19.93			
Pairwise Comparison Between all	-2.200*	0.474	**0.001**
subjects baseline to post session 3			
Pairwise Comparison Between all	-3.950*	0.609	**0.000**
subjects baseline to post session 6			
BRAIN FOG (N=20)	**Mean**	**Std. Deviation**	**P Value**
Results: Brain Fog reduced, the trend			
to concentrate better as more sessions			
received			
Baseline	3.55	2.61	
Post Session 3	2.75	1.83	**0.085**
Post Session 6	1.9	1.45	**0.006**
Within Subject Factors:	0.406		
Partial Eta Squared Linear accu			
Statistical Test Within Subjects - Type	27.225		**0.002**
III Sum of Squares			
Statistical Test Between subjects -	448.267		**0.000**
Type III Sum of Squares -Intercept			
Within Subject Factors: Multivariate	0.406		**0.009**
Test- Pillai's trace value = .			
Within Subject Factors: Multivariate	0.594		**0.009**
Test- Wilks Lambda Value			
Pairwise Comparison Between all	0.8	0.337	**0.085**
subjects baseline to post session 3			
Pairwise Comparison Between all	1.650*	0.46	**0.006**
subjects baseline to post session 6			

Table 3: 95% confidence Interval for difference, adjustment for multiple comparisons: Bonferroni. 95% confidence Interval for difference, adjustment for multiple comparisons: Bonferroni. 95% confidence Interval for difference, adjustment for multiple comparisons: Bonferroni.

*The mean difference is significant at the .05 level. *The mean difference is significant at the 0.5 level. *The mean difference is significant at the .05 level.

Discussion

Long-hauler COVID poses a significant health burden and adversely impacts quality of life for many adults [14-16]. The most commonly reported experienced symptoms include dysgeusia, anosmia and brain fog [2,3]. Evidence suggested that acupuncture may be an effective strategy for these three symptoms [8]. Our pilot study contributes to this evidence. We found the targeted acupuncture protocol had statistically significant improved smell ($p=0.001$) and taste ($p=0.002$) after the third treatment, and improved cognition after six treatments ($p=0.006$). There were no differences in the demographic data of our participants.

Acupuncture is a therapeutic method used in Traditional Chinese Medicine (TCM). Acupuncture is based on the premise that energy "Qi" flows within the body along meridians where acupuncture points are located [17]. It is believed that illnesses and symptoms appear when the flow of Qi is disrupted and becomes unbalanced [17]. Thinking of this idea of balance and flow of Qi from a western perspective can be compared to the body achieving homeostasis [18,19].

Participants in this study presented with different TCM patterns, but they consistently showed signs of deficiency. In order to treat each patient with the same 9 point protocol, (Table 4), the treatment plan was to tonify blood and Qi while using specific Acupuncture points that nourish the brain and help regain sense of smell and taste [19-23].

It has been reported that acupuncture can provide anti- inflammatory effects by stimulating the skin which is then transmitted to the

brain [16,24]. This stimulation can then activate the central nervous system which smell and taste are part of [18]. Recent studies have also shown acupuncture can release certain neuropeptides in the central nervous system, which can cause physiological effects as well as activating self healing mechanisms [24,25].

Points	Location
GB 20	Located in a depression between the upper portion of the sternocleidomastoid
	muscle and the trapezius, level with GV 16. Known to dispel Exterior or
	Interior Wind fever/chills, paralysis, tremors, numbness, dizziness, vertigo. All
	issues of the head, brain (seizures, memory, and mental/neurological
	disorders), face, throat and sense organs (eyes, ears, nose, tongue).Headache,
	especially occipital. Shoulders and/or upper back - pain, weakness, stiffness.
LI 20	Located in the nasolabial groove, level with the midpoint of the lateral border
	of the ala nasi. Known to assist with loss of smell or taste, nasal discharge, any
	nose and/or sinus issues, nasal polyps, rhinitis, sinusitis, allergies.
LI 4	Located in the middle of the 2nd metacarpal bone on the radial side. Known to
	release the exterior for wind-cold or wind-heat syndromes. Strengthens the wei
	qi, improves immunity. Any problem on the face - sense organs, mouth, teeth,
	jaw, toothache, allergies, rhinitis, hay fever, acne, eye problems, etc. Headache,
	especially frontal and/or sinus. Chronic Pain .Influence the circulation of Qi
	and Blood - Use the four gates, LI 4 & LV 3 to strongly move the Qi and
	Blood in the body clearing stagnation and alleviating pain.
K3	Located In the depression midway between the tip of the medial malleolus and
	the attachment of the Achilles tendon. Known to tonify KD Qi, Yin or Yang
	Deficiencies from any etiology. Asthma from KD Deficiency - difficulty
	inhaling. Tonifies Yin of KD), LV (dizziness, tinnitus, headache) and/or HT
	(anxiety, insomnia, excessive dreaming). Low back pain, usually of a chronic
	nature.
Shen Men	Situated at the apex of the triangular fossa of the ear. Shen Men is of the most
	recognized auricular points and is known to have a powerful influence in
	treating pain, anxiety, addiction and inflammation.
LV 3	Located on the dorsum of the foot in a depression distal to the junctions of the
	1st and 2nd metatarsal bones. Generally, resolves stagnation and tonifies Yin -
	balancing for all LV pathologies. LV Qi Stagnation / LV Yang Rising -
	headaches, dizziness, canker sores. Stagnation in the middle warmer -
	subcostal tension, chest/flank pain, swellings in the axillary region. Calming
	point - anger, irritability, insomnia, anxiety. With LI 4, four gates treatment -
	powerfully work on the flow of Qi and Blood in the body.
ST 36	Located 3 cun below ST 35, one finger width lateral from the anterior border
	of the tibia. Known to tonify deficient Qi and/or Blood. Tonify Wei Qi and Qi
	overall - low immunity, chronic illness, poor digestion, general weakness, very
	important acupuncture point for building and maintaining overall health. All
	issues involving the Stomach and/or the Spleen - abdominal/epigastric pain,
	borborygmus, bloating, nausea, vomiting, GERD, hiccups, diarrhea,
	constipation, etc. Will support Lung function in cases of asthma, wheezing,
	dyspnea. Psychological/Emotional disorders - PMS, depression, nervousness,
	insomnia.
DU 20	Located on the head, 5.0 cun directly above the midpoint of the anterior
	hairline. Known to assist with headache, vertigo, tinnitus, nasal obstruction,
	aphasia by apoplexy, mental disorders, prolapse of the rectum and the uterus.
	Clears the mind, lifts the spirits, tonifies yang, strengthens the ascending
	function of the Spleen, eliminates interior wind, and promotes resuscitation.
YinTang	Located midway between the medial ends of the eyebrows. Known to assist
	with frontal headaches, sinus issues, congestion and sinusitis. Also known to
	assist with anxiety, insomnia and stress [21].

Table 4: ACCOLADE Acupuncture Protocol 6 treatments (2 per week) for 3 weeks to 9 points.

Anosmia (smell)

Improving taste and smell impairments is critical to personal safety and life satisfaction. The lack of ability to smell hazardous chemicals, gas leaks, smoke or food spoilage poses safety risks to adults [22,26,27]. Moreover, Burges Watson and colleagues found adults experiencing anosmia reported significant weight loss, loss of social bonding and intimacy [27]. Prior research studies also show that systemic steroids improve anosmia for this population, but extensive literature supports long term use of steroids poses significant adverse reactions and risks [22]. None of the ACCOLADE study participants nor participants from Morita and colleagues [22] reported any adverse effects suggesting that acupuncture may be a safer alternative

than steroids. In a case report (two participants with long-hauler COVID-19), the researchers used acupuncture to the Yingxiang point (LI20), right and left sides, until the participants felt the de qi sensation with the left needles in the place for 15 min, with treatments 1-2 times per week and reported the symptoms of olfactory dysfunction were improved [22]. This acupuncture point (LI20) was also part of our 9 point protocol and possibly one of the most important points used in our study for anosmia.

Dysgeusia (taste)

Similar to olfactory dysfunction, the loss of taste impacts quality of life and mental well being [27,28]. Moreover, Burges Watson and colleagues found many adults reported experiencing severe metallic taste that resulted in weight changes [27]. Although the precise pathogenesis of dysgeusia from long-hauler syndrome remain elusive, researchers hypothesize that dysgeusia may be related to the COVID-19 due to the angiotensin-converting enzyme 2 (ACE2), a functional receptor for the virus, which is highly expressed in the salivary gland [29,30]. Our ACCOLADE protocol showed improved perception of taste with initial improvements starting at week two, after the third acupuncture treatment, and continued improvement in taste perception after the sixth treatment. Currently, a systematic review is ongoing exploring the combination of Moxibustion therapy which is hypothesized to stimulate the acupoints of the human body with a warming effect to improve taste disorders associated with COVID-19 long hauler syndrome [29]. Collectively, with our study as well, this information provides evidence for the importance of evaluating the effectiveness of acupuncture for taste disorders due to its overarching impact on quality of life.

Brain fog

Fischer and colleagues, in a cross-sectional study, found that the majority of participants experienced some form of cognitive dysfunction associated post COVID-19 [31]. The most common reported cognitive dysfunctions included memory loss (15%) and mental confusion (15%) [31]. Interestingly, the researchers found these symptoms remained bothersome to the participants still at 12- months post COVID-19, suggesting significant long term impact to quality of life and overall well being [31].

Peng and colleagues found that using electroacupuncture at the acupoints DU20 (Baihui), DU24 (Shenting) and EX-HN1 (Sishencong), for 30 minutes, three times/ per week for 4 consecutive weeks showed significant improvement in participants (N=57) experiencing brain fog [32]. Electroacupuncture is known to provide anti-inflammatory effects which experts believe is the underlying cause of multiple COVID-19 long hauler symptoms [32]. We did not use electroacupuncture in our study, but we did use DU20 as one of the most beneficial points to address brain fog. Within our study, we saw a significant improvement in brain fog, with a trend down in the PROMIS® Cognitive Function - Abilities scale after the sixth acupuncture treatment (Table 2).

Strength of the study

This study used validated instruments for measuring the four dependent variables. None of the participants reported any adverse effects. All participants completed the protocol. Multiple steps were taken to ensure intervention fidelity.

Conclusion

All 20 participants completed the 9 point acupuncture protocol of 6 treatments (twice a week for 3 weeks) which revealed statistically significant improvement for taste ($p < 0.000$), smell ($p < 0.000$) and brain fog ($p = 0.002$). The findings from this present study also showed that Acupuncture significantly improves taste ($p = 0.002$) and smell ($p = 0.001$) after receiving 3 treatments. This information gives reason to disseminate the positive effect of Acupuncture on COVID 19 Long Hauler Syndrome.

Limitation

This study was a pilot, not randomized study with a small sample size. Selection bias is a threat to validity. The findings may have limited generalizability due to lack of gender and racial diversity. Hence, future larger scale experimental design studies are needed. This study was not funded.

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