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Evaluating the Relationship Between Somatic Dysfunction, Physical Activity Level, and Perceived Stress Level: A Pilot Study

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Abstract:

Introduction:

Somatic dysfunction (SD) is the basis for osteopathic manipulative treatment (OMT). SD is found through palpatory physical assessment and represents a degree of strain on the homeostatic system of the body. This study investigates the relationship between SD and physical activity (PA) level as well as perceived stress level (POMS).

Methods:

This observational cohort study collected Somatic Dysfunction Scale (SDS) scores together with a score from a perceived stress questionnaire, the Profile of Mood States (POMS), and an activity level assessed with via a physical activity (PA) questionnaire. Data was collected on three separate days, approximately 6 weeks apart. Questionnaires were administered and collected initially, then SDS scores were assessed independently by two examiners that were blinded from each other and from the questionnaire data.

Results:

There was no significant relationship between SD and POMS or PA. There was a possible significant inverse relationship between the TMD from the POMS and a moderate level of PA with a negative Spearman rank correlation (-.194) and p=0.089. There was a statistically significant correlation between examiners' SDS scores.

Conclusion:

Stand-alone SDS values may not be a useful measure to correlate with stress levels and activity levels. However, SDS values may be used to assess the longitudinal response to interventions such as OMT.

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Introduction:

Osteopathic Manipulative Treatment (OMT) is a manual treatment that is the primary modality for a diagnosis of somatic dysfunction (SD). Prior to utilizing this hands-on treatment in a healthcare setting, SD must first be diagnosed within the patient. Somatic dysfunction (SD) is known as altered or impaired function of related components of the somatic system; skeletal, arthrodial, myofascial, vascular, neural, and lymphatic.[1] A diagnosis of SD within the neuro-musculoskeletal components of the patient implies that physical exam would reveal at least two of the four following components within a localized area of the body; tissue Texture abnormality, Asymmetry, Restricted movement, and Tenderness. These findings are frequently represented by the mnemonic 'TART'. Once a diagnosis of SD has been established, OMT can be utilized to treat the patient with the intention of improving the clinical outcome.

OMT is known to have a positive impact in hospitalized patients as demonstrated by reduced length of stay in NICU infants[2] as well as adult pneumonia patients,[3] those with post-operative ileus,[4] lower urinary tract symptoms,[5] Covid infection[6] and even pancreatitis.[7] Patient satisfaction has been observed to be positively impacted using OMT.[6,8,9] Osteopathic principles put forward that SD impedes the body's ability to heal and maintain health, and the report of positive clinical outcomes supports this

principle. However, SD can occur in a wide range of severities from very mild to very severe, and people may vary in their response to SD both physiologically and psychologically. This study is designed to investigate any correlation between SD in the body and a measure of mood (Profile of Mood States) as well as physical activity (PA) levels.

Somatic symptoms and SD are not necessarily the same thing. Symptoms are perceived and reported by patients. On the other hand, SD is evaluated by physical exam performed on the patient. The Profile of Mood States (POMS) questionnaire has been used to investigate somatic symptoms[10] as well as somatization of symptoms.[11] POMS for the subscales of tension-anxiety (TA), depression (D), and fatigue (F) were indirectly associated with somatic symptoms in evaluation of the effectiveness of a 4-week self-help internet-based cognitive behavioral therapy (ICBT) program.[10] The Brief Job Stress Questionnaire was used to assess somatic symptoms in that study. This intervention yielded reduction in low back pain for somatic symptoms and tension-anxiety but not for depression and fatigue.[10] In another study, the POMS questionnaire was used to evaluate the relationship between gender and the somatosensory amplification in relation to perceived work stress and social support.[11] Given the effectiveness of the POMS questionnaire in these prior studies, this study elected to use this measure to investigate any correlation between SD and mood states.

Physical activity is generally considered to have benefit for our mental and physical well-being. One study of a large cohort of college students found that both somatic and psychological symptoms were milder in students with a high level of physical activity, and that depression and anxiety scores were significantly lower in students with a high level of physical activity compared to those who had medium or low levels of physical activity.[12] Another study of a large cohort of female higher education students investigated a correlation between anxiety, depression, somatic symptoms, and physical activity. They found that increased sports activity decreased the severity of depressive symptoms.[13]

This study is aimed at using a Somatic Dysfunction Scale (SDS) which provides a single score to represent the overall somatic dysfunction burden within an individual patient. We would like to see if the SDS score has any correlation with physical activity level (PA) and POMS as a means of investigating the role of SD in these other functional measures. A Somatic Dysfunction Scale (SDS) has been previously used as an objective measurement in a crossover study comparing OMT and Breathing exercises revealing a statistically significant correlation.[14]

Methods:

This study was approved by the Lincoln Memorial University IRB (#1057). Data collection occurred on three separate days over a 3-month period, with approximately 1.5 months between dates. Participants arrived at prescheduled times to a clinical education facility where they were asked to complete a written informed consent form, a physical activity (PA) questionnaire, and a stress appraisal questionnaire (POMS40). The PA questionnaire quantified the participant's current level and intensity of PA. It contains four chronological questions that provide a subjective indication of the PA level over the last 7 days and compare that to the previous 3 months to denote any changes. The stress questionnaire is the Profile of Mood States (POMS) which quantified the participant's current level of perceived stress due to regular daily stressors. The POMS is a commonly used measure of psychological distress. It consists of 65 adjectives, which respondents indicate the degree to which each adjective describes themselves during the last week using a 5-point Likert scale format. Standard scoring of the POMS yields a global distress score referred to as Total Mood Disturbance (TMD).

After completing the surveys, each participant underwent two successive screening assessments for somatic dysfunction (SD) using the Somatic Dysfunction Scale (SDS) which intends to provide a single numeric score to determine the participant's level of SD burden for the whole body. The SD assessment was performed by two different examiners who are both trained in the assessment of SD. One is an OPP faculty with 15 years of clinical experience, the other is an OMS3 student currently spending the year as an OPP scholar. Neither researcher conducting assessments was aware of the other's results for a particular participant and each performed the assessment in separate exam rooms. This screening assessment was performed with a

maximum allowed time of 10 minutes for each participant. Standard documentation of SD occurs in 10 body regions, however this SDS was modified to include 13 sections as follows: upper cervical, lower cervical, upper extremity, thoracic inlet, thoracic spine, ribcage, thoraco-abdominal diaphragm, abdomen, lumbar spine, sacrum, pelvis/innominate, pubic symphysis, and lower extremities. As a screening assessment, the examiners assigned a score between 0 and 4 for each region. A score of 0 indicates no significant somatic dysfunction for that region. A score of 1 indicates a minimal amount of asymmetry and tissue texture abnormality that is both non-tender and does not seem to create significant restriction for surrounding tissues. A score of 2 indicates at least a level 1 plus tenderness. A score of 3 indicates more significant restrictions and marked abnormalities in tissue texture, with some points of tenderness and level 1 findings. Level 3 was omitted for several sections: upper cervical, thoracic inlet, thoraco-abdominal diaphragm, abdomen, sacrum, pelvis/innominate, and pubic symphysis. The remaining sections (lower cervical, upper extremity, thoracic spine, ribcage, lumbar spine, and lower extremity) could potentially have more widespread findings and a level of 3 for these regions allowed for some variation. A score of 4 indicates a significant level of somatic dysfunction and restrictions exhibited by marked findings of increased tenderness along with alterations in tissue texture changes, obvious positional preference and/or asymmetry. Grade 4 is indicative of significant increases in dysfunction because of its multiple and widespread findings. Scores for each region were then tallied to create the final SDS score between 0 and 52.

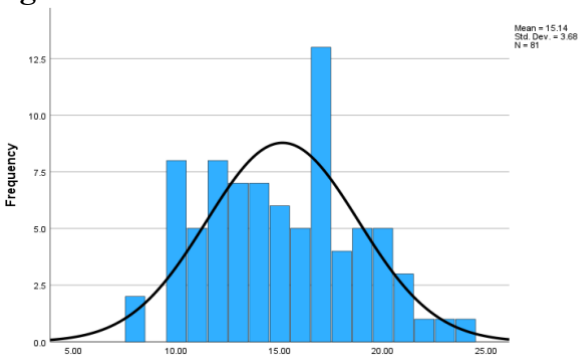
Statistical analysis

Following data collection, individual SDS scores were ranked as low, medium, and high. One-way Analysis of Variance (ANOVA) was conducted to determine if a difference occurred between SDS and PA and TMD scores. Spearman's Rank correlation was used to determine the strength of relationship between SDS, TMD, PAMod, and PAVig. If allowed, Tukey post hoc multiple comparisons will follow the ANOVA to determine where the difference between variables occurred. Pearson's correlation was used to determine a relationship between SDS scores among both researchers. Statistical significance was determined a priority as $p \leq .05$.

Results:

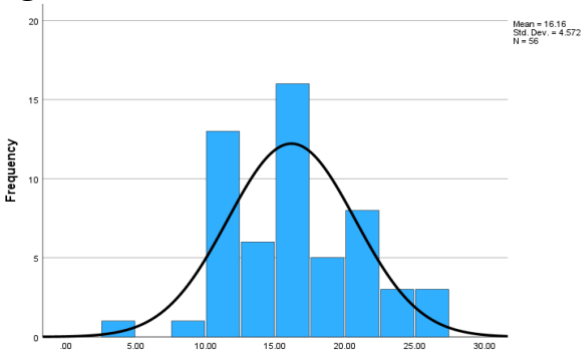
Figures 1 and 2 show the distribution of SDS scores for examiner's A and B respectively. This distribution represents data collected on 3 separate days. Examiner B was absent for day 1 data collection, therefore figure 2 shows an n of "56 "whereas figure 1 shows an n of "81".

Figure 1: SDS scores: Examiner A



Days 1,2, 3, with a total n of 81, Mean = 15.14, Std. Dev 3.68
SDS = Somatic Dysfunction Scale

Figure 2: SDS scores: Examiner B



Days 2, 3, with a total n of 56, Mean = 16.16, Std. Dev = 4.572
SDS = Somatic Dysfunction Scale

Pearson Correlation coefficient for SDS scores was significant between researchers A and B (see table 1).

Table 1: Pearson's correlation between SDS scores

Pearson's r	Sig. (2-tailed)	n	95% CI
0.431*	<0.001	54	0.220 - 0.648

Days 2 & 3. * Indicates statistical significance ($p \leq 0.05$)

There was a weak correlation in the inverse relationship between the TMD from the POMS and a moderate level of PA (Spearman's rank -0.194) with

possible significance (p=0.089). Additionally, there is a moderate correlation between the moderate and vigorous PA levels (Spearman rank of 0.372) with a p-value<0.001 (see table 2).

Table 2: Spearman's rank correlation

Correlation between SDS (researcher A), TMD, PAMod, PAVig.			
SDS A	TMD (.122)	PAMod (.129)	PAVig (-.100)
TMD	SDS A (.122)	PAMod (-.194)	PAVig (-.086)
PAMod	SDS A (.129)	TMD (-.194)	PAVig (.372)*
PAVig	SDS A (-.100)	TMD (-.086)	PAMod (.372)*

* Indicates statistical significance ($p \leq 0.05$)

There was no statistically significant difference between SDS score and moderate PA ($F(2,78) = 1.345$, $p = 0.267$), vigorous PA ($F(2, 73) = 0.103$, $p = 0.902$), and TMD ($F(2, 78) = 1.491$, $p = 0.232$).

Discussion:

The inverse correlation between TMD, as measured with POMS, and moderate PA level suggests that a moderate level of PA is more effective at mitigating mood and stress response on a psychological level while there is no significant discernable correlation with SD in this cohort. This is congruent with similar findings regarding physical activity and psychological symptoms.[12,13] This study did not make any distinction of the type of physical activity performed. We asked people to report on their level of activity, and found a correlation between activity level and mood, but no correlation with somatic dysfunction. It may be useful in future studies to distinguish the type of physical activity while assessing any correlation with SD.

SD assessment and documentation is essential to the utilization of OMT. OMT is the primary treatment utilized in the osteopathic paradigm, and it has shown itself to be effective in the clinical management of patients who are either hospitalized or presenting as an outpatient with a medical issue. The palpatory findings associated with SD fall within a spectrum of seemingly mild to severe. Presumably, at some level of severity, SD becomes clinically relevant. The osteopathic profession has developed a comprehensive pathophysiologic understanding of how the nervous system responds and adapts to the presence of SD that correlates with a progression from mild and intermittent symptomology to chronic and potentially decompensating symptomology.[1] Despite the detailed neurophysiologic sequelae of chronic somatic dysfunction and its potential resulting effects on the systems of the body, the nuances from psychological factors as well as physical behaviors and movement patterns on SD could be better understood.

Conclusion:

Our data showed no significant relationships between somatic dysfunction (SD) and Profile of Mood States (POMS) or physical activity level (PA). Stand-alone Somatic Dysfunction Scale (SDS) values may not be a useful measure to correlate with stress levels and activity levels. However, SDS values may be used to assess the longitudinal response to interventions such as osteopathic manipulative treatment (OMT).

Author Contributions:

All authors contributed equally to the conception and design, acquisition of data, or analysis, interpretation of data, manuscript preparation and review.

Potential Conflicts of Interest Disclosures:

The authors disclose that there were no conflicts of interest or financial support in the development of this project. All data is authentic and accurate.

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