Original Research Article

TO STUDY ABO BLOOD GROUP CORRELATION WITH PAIN PRESSURE THRESHOLD AND TOLERANCE, CORE STABILITY IN YOUNG HEALTHY INDIVIDUALS

ABSTRACT

Background- The term "blood type" refers to the antigen phenotype, which is the serologic expression of the inherited blood group genes, such as A, B, and O in the ABO system. Physical fitness as an important factor in assessing a person's physical health and motor ability consists of various components such as core endurance and strength. Pain pressure threshold is determined as the duration of time between the subject's first reported pain and exposure to the painful stimulus or the minimum force applied to induce pain.

Methodology- Healthy male and female volunteers within the age range of 18–25 years were recruited for this co-relational study based on inclusion and exclusion criteria. The study consisted of one experimental session in which a questionnaire was filled out, a blood type test was performed, and two rounds of pressure pain thresholds (PPTs) over the core muscles i.e. over Rectus Abdominis, transverse abdominis, Multifidus and erector spinae were obtained separated by a cold pressor test (CPT). The session lasted 30 min. The study was approved by the ethical committee of Santosh university, Ghaziabad and conducted within the timeline of May-august 2021 at the Department of physiotherapy, Santosh hospital, Ghaziabad, U.P.

Result- t test, Anova and Karl Pearson correlation method was used to analyze the data. Result shows that both core stability and pain tolerance has significant difference and association among different blood groups ($p>0.05$). Also blood group O has the least mechanical sensitivity as it has the highest pain tolerance(mean ± SD= 56.48 ± 37.39) after CPT test. Also B+ has the good core stability as compared with means (mean ± SD= 48.50 ± 27.44) of other blood groups.

Conclusion- Study concluded that there is significance association among different ABO blood group and pain tolerance in healthy young Indian individuals which shows evidence

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that blood groups can be incorporated in physical therapy assessment and management.

KEYWORDS
PAIN THRESHOLD AND PERCEPTION, CORE STABILITY, COLD PRESSOR TEST, ABO BLOOD GROUP.

INTRODUCTION

Pain is one of the most common ailments in a myriad of diseases. Pain relief therefore is very important in ancient and modern medicine. Pain is a sensation of discomfort, providing the organism with a protective mechanism to survive. Acute pain is defined as an 'unpleasant, complex, dynamic psycho-physiological response to tissue damage, disease or inflammation' and often lasts for a short period. Chronic pain is presented as a continuous hyper-excitable neuronal state with lack of inhibitory neuronal function. Pain perception is operationalized as the following three measures: perceived pain intensity, pain threshold (ie, the point at which participants indicate they feel pain), and pain tolerance (ie, ability to withstand pain). Pain pressure threshold is determined as the duration of time between the subject's first reported pain and exposure to the painful stimulus or the minimum force applied to induce pain. Pain tolerance was determined as the duration of the time until the subject withdrew his/her hand from the cold water as the pain was too intensive. The term "blood type" refers to the antigen phenotype, which is the serologic expression of the inherited blood group genes, such as A, B, and O in the ABO system. These blood groups are polymorphic, inherited, antigenic carbohydrate present on the surface of erythrocytes and other tissues. Core stability is defined as the ability to control the position and motion of the trunk over the pelvis to allow the optimum transfer of energy from the torso to extremities when performing athletic activities, which are often composed of highly loaded movements (Kibler, Press, & Sciascia,2006). Different genes have been identified to be associated with pain, for example, the catechol-O-methyl-transferase gene. Several phenotypic

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factors have provided a way to predict pain sensitivity including sex, ethnicity, and eye and hair color (Fillingim et al. 2005, 2009; Mogil et al. 2005; Tegeder et al. 2006; Anderson et al. 2009). A less studied phenotype in relation to pain perception is the ABO blood type. Till date according to researcher knowledge there is no study done who has seen the correlation between pain pressure threshold and pain tolerance and core stability in young healthy Indian individuals. Thus the present study aim to study the correlation of the four factors with ABO blood group system. Also the main objective of this study was to find out the influence of pain perception and core stability in different blood groups so that when patient visiting for the physical therapy management, dosage can be set according to the blood groups and blood group can be incorporated in the assessment as well.

Methodology

Healthy male and female volunteers within the age range of 18–25 years were recruited for this correlational study. Participants were screened to ensure compliance with eligibility criteria according to the study protocol and excluded if any participants having any of the following conditions- if participant takes alcohol or if drug abuse, Dermatoses at the site of pain stimulation,Endocrine disorders, Hormonal therapy, Gynaecological disease. Menstruation, Any systemic illness, Immunological disorder, if participant not giving consent, Metabolic diseases,Osteoporosis, Pregnancy. The study consisted of one experimental session in which a questionnaire was filled out, a blood type test was performed, and two rounds of pressure pain thresholds (PPTs) over the core muscles i.e. over Rectus Abdominis, transverse abdominis, Multifidus and erector spinae were obtained separated by a cold pressor test (CPT). The session lasted 30 min. The study was approved by the ethical committee of Santosh university, Ghaziabad and conducted within the timeline of May-august 2021 at the Department of physiotherapy, Santosh hospital, Ghaziabad, U.P. All participants gave written informed consent prior to execution of the study. Total of 175 students were recruited from Santosh medical and dental college, hospital, Ghaziabad for the study. 160 students participated in the study on the

basis of inclusion and exclusion criteria. Detailed oral explanation regarding the nature, purpose and requirements of the study was told to all subjects. After obtaining written consent including the unconditional agreements of the subjects, blood samples were taken to determine the blood groups by the experts from the pathology lab. A series of test was performed to take the appropriate data. Following a brief technique demonstration, and detailed instructions, participants were tested individually.

Blood type

The blood samples were collected by vein puncture with 2 ml emptied into EDTA bottles and used for blood grouping. Blood grouping was done on standard protocols described by Dacie and Lewis (1991). Three clean glass slides were taken on which a drop of known anti-sera (anti-A, anti-B and anti-D;) were put. A drop of blood sample was added to each one of it. Using the edge of separate slides the blood was properly mixed with the anti-sera. The slides were kept undisturbed for 1-2 minutes at about 37 degrees. The presence of agglutination confirmed under microscope indicated the presence of that respective blood group and the Rh factor.

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Pressure pain threshold

Pressure pain threshold (PPT) was measured using a handheld algometer (probe diameter: 1 cm) (ORCHID PRESSURE ALGOMETER, India) before and immediately after CPT to test functionality of the internal pain inhibitory mechanisms using conditioned pain modulation (CPM). CPM is considered a relevant clinical test and a commonly used model to evaluate endogenous pain modulation, which usually involves inhibition of a pain stimulus during exposure to a second noxious conditioning stimulus (i.e., cold water) (Lewis et al. 2012; Kennedy et al. 2016). The following test sites were assessed: the rectus abdominis muscle, the transverse abdominis muscle (both identified by manual palpation during sit up position in supine lying position), and the erector spinae and mutifidus in prone lying position. Participants were comfortably placed on the couch with the help of pillow as head/ shoulder support during execution of PPT tests. The algometer probe tip was placed perpendicularly on the skin at the test site and pressure was applied according to instructions with slope settings at 30 kPa/s. The participants were asked to say yes as soon they first felt the transition of increasing pressure to a

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sensation of pain. PPT was measured at each muscle twice before and after CPT test in a proper sequence, randomly starting from Rectus abdominis then transverse abdominis and then Multifidus and erector spinae and an data was obtained for further analysis.

Cold pressor test

Participants were asked to immerse the non-dominant foot into the ice-water bucket. The bucket was filled with cold water (4 liters) and kept at a temperature range of 1–4 _C by adding ice cubes (Holmgaard et al. 2017). Temperature was monitored by a manual thermometer. Participants were instructed to keep the foot in the ice-water while rating the intensity of pain every 10 s on a visual analogue scale (VAS) and first time with help of stop watch was noted when participant reported first pain sensation and when pain was unbearable participant withdraw from the bucket and time was noted respectively.

Core stability

Participant after completing the cold pressor test series were asked to perform plank test to measure the core stability. Each participant was instructed how to perform the plank test. The test procedures were as follows: the subject assumed the forearm plank position with elbows in contact with the ground, such that the humerus formed a perpendicular line to the horizontal plane, directly beneath the shoulders. The forearms were in neutral position and hands were directly in front of the elbows. The participant assumed a rigid anatomical body position so that only their forearms and toes supported the body. This position is characterized by a phalangeal extension, neutral ankle position, knee and hip extension, and neutral spinal positions. The participants were instructed to statically hold this position as long as possible and verbal cues were provided to the participant briefly in order to promote form adherence. When the subject assumed the proper position, the investigator started the stopwatch. The test was terminated when (1) the participant fatigued or voluntarily stopped the test, (2) the participant failed to maintain the proper position,(3) the participant reported ill effects from the test (e.g. headache, dizziness, pain not associated with fatigue, etc.), or the investigator noticed signs indicative of ill effects in the participant from the test. At the conclusion of the test, hold time was recorded with the help of stopwatch.

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After completing the test and experiment series data was then analysed.

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Statistical analysis

After data is being collected, its mean& standard deviation and covariance will be calculated to get Karl Pearson correlation using SPSS software. One way- Anova was used to analyse the significant difference between and with in group.

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Results

Participants and study design

A total of 160 participants completed the study with the mean age of 21.50 years (Range- 18-25 years) and the distribution according to blood group is shown in pie graph 1.

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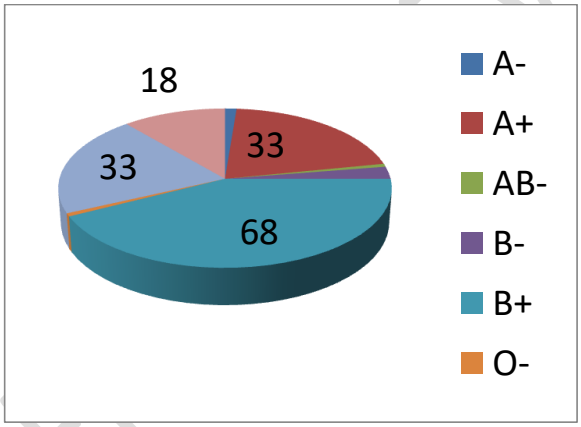

Graph 1- Blood Group Distribution

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Table 1 Represents pre and post comparison of Cold pressor test on core muscles.

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MUSCLE POINTS	PRE MEAN ± SD	POST MEAN ± SD	MEAN DIFFERENCE	t-value	Sig value
RECTUS ABDOMINIS	51.32± 46.27	50.59 ± 19.73	.7269	.215	.830
TRANSVERSE ABDOMINIS	47.39 ± 17.911	50.32 ± 19.22	-2.931	-3.66	.000*
MULTIFIDI	83.80 ± 36.025	88.87 ± 37.749	-5.069	-4.624	.000*
ERECTOR SPINAE	74.33 ± 31.58	77.83 ± 32.35	-3.500	-2.841	.000*

*** significant at the 0.05 level (2-tailed).**

GRAPH 2 REPRESENTS PRE AND POST COMPARISON OF COLD PRESSOR TEST

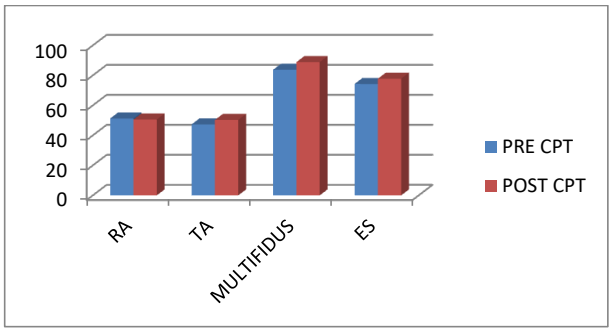

TABLE 2 - BLOOD GROUPS AND CORE STABILITY via PLANK TEST

BLOOD GROUPS (n=152)	MEAN ± S D	95% CONFIDENCE INTERVAL	F value	p-value
A+ (n=33)	39.15 ± 27.64	48.95 – 29.35	2.543	.048*
AB+ (n=18)	36.61 ± 23.40	48.25 - 24.97		
B+ (n= 68)	48.50 ± 27.44	55.14 – 41.86		
O+ (n=33)	35.94 ± 17.68	42.21- 29.67		

* significant at the 0.05 level (2-tailed).

TABLE 3 REPRESENTS BLOOD GROUPS AND PAIN TOLERANCE

BLOOD GROUPS (n= 152)	MEAN ± S D	95% CONFIDENCE INTERVAL	F value	p-value
A+ (n=33)	31.09 ± 14.92	36.38 – 25.80	3.103	.029*
AB+ (n=18)	45.33 ± 47.39	68.90-21.76		
B+ (n= 68)	47.72 ± 36.11	56.46-38.98		
O+ (n=33)	56.48 ± 37.39	69.75-43.22		

* significant at the 0.05 level (2-tailed).

TABLE 4 REPRESENTS BLOOD GROUPWISE PAIN PRESSURE THRESHOLD EFFICIENCY

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BLOOD GROUP	MEAN PERCEPTION	MEAN TOLERANCE	EFFICIENCY FORMULA	EFFICIENCY PERCENTAGE
A+ (n=33)	15	31	$\frac{31-15}{15} \times 100$	106.67%
AB+ (n=18)	12	45	$\frac{45-12}{12} \times 100$	275%
B+ (n= 68)	17	48	$\frac{48-17}{17} \times 100$	182.35%
O+ (n= 33)	21	56	$\frac{56-21}{21} \times 100$	166.67%

DISCUSSION

The aim of the present research was to identify the association between different blood groups and pain tolerance and threshold, core stability and Body mass index in healthy young Indian individual. The total of 160 participants was involved in the study with mean age of 21.50 years, (males- 76 females- 84). This is the first study in the literature measuring pain perception and threshold on core muscles using cold pressor test. Also the result of the present study shows significant difference over Erector Spinae, Transverse Abdominis and Multifidus ($p < .05$) but no significance difference over Rectus Abdominis muscle was observed. Finding from this study observed that every individual with their unique blood types have different pain sensitivity to mechanical stimuli reflected on PPT values and different levels of internal pain inhibitory capacity reflected on the cold pressor modulation effect.

Pressure pain threshold

One of the objectives of the present study was to investigate whether pain perception differs between different blood groups when measured over the core muscles in healthy young Indian individuals. Participants with blood type O+ possess the lowest pain sensitivity at baseline and post CPT measurements when measured at all the core muscles. The result could be supported by another study did by Diatchenko et al. (2005) which indicates that general sensitivity might be associated with an increased risk of future development of chronic pain for example low back pain. The present study shows overall high pain mechanical sensitivity in other blood groups which indicates that other blood groups are also prone to develop chronic pain in their later 50's age. In the present study, a result varies in different blood types might be due to their unequal distribution. PPTs before and after CPT were compared in order to investigate if the internal pain inhibitory system is active and functional in the healthy participants and if this functionality is ABO dependent or not. A tendency was found towards a decrease in mechanical pain sensitivity after CPT among all blood types, of which some were found significant. This is in agreement with findings in a study by Knudsen and Drummond (2009) that observed decreased mechanical pain sensitivity on the forehead after CPT conducted in both 2 and 4 _C cold water. The decrease in sensitivity indicates functioning of the pain inhibitory modulation system. As not all blood type groups exhibited a significant decrease in pain sensitivity after CPT, not all participants

exhibited the expected CPM effect. A study by Locke et al. (2014) found that a proportion of healthy test subjects show no effect of CPM in relation to CPT.

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Core stability

The primary aim of the present research was to investigate the association of different ABO blood group with core stability. Core endurance was measured by plank test which is the standardized test for measuring core muscle strength and endurance. The result of the present research shows that there is significant difference in core stability between the different blood group types. Also it was found that individuals with blood group type B+ have maximum core stability when compared with other types of blood group. This could be in association with another study done by Lippi et al (2017) who investigated running endurance with ABO blood group system on 52 recreational athletes and found that athletes with O blood group have better endurance than non-O. More specifically, a deep analysis of the structural and physiological features characterizing endurance running ability has recently contributed to unmask many aspects of the genus Homo, which would ultimately confer more sustained endurance running capability compared to other primates. These aspects especially include long legs with tendons attaching short muscle fibers to the bones, a typical plantar arch of the feet, short toes, specific muscles conformation, anthropomorphic alterations of hips and shoulders, sweat glands, reduced hair mass, mouth breathing and a body suited for a more efficient heat dissipation. Another recent study found a significant correlation between ABO blood groups and the muscular structure which resulted in O blood group trait against rupture of muscular tendons (Beom *et al.*, 2007). In another study, there was no relation between blood groups muscle flexibility (Kunher *et al.*, 2005).

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CONCLUSION- The present research alternate hypothesis is partially accepted There is an association of pain sensitivity and blood group, with individuals having blood group A having least pain tolerance, while individuals having blood group O showing highest pain tolerance. Also B+ have good core stability as compared to other blood groups.

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LIMITATION AND FUTURE SCOPE

Unequal distribution of blood groups at local and global level and also the inability to enrol equal number of subjects having different blood groups in the present study also might have influenced the results of the study inviting the need of further research. Further limitations were faced

regarding CPT. Ideally, the temperature should have been kept at a constant level in order to avoid variations in cold receptor responses.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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