

A STUDY OF PSYCHO-PHYSIOLOGICAL CORRELATES OF YOGA PRACTITIONERS AND SUBSEQUENT GENDER COMPARISON

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DOI Link: <http://doi-ds.org/doi/10.2020-67128241/>

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| Abstract | <i>Yoga practices have become increasingly popular due to government impetus in India and in western countries for leading a healthy lifestyle and as a method for coping with stress, tension, and anxiety. However, little is known about the innate physiological and psychological effects of yoga practice that are not visible with naked eye and requires usage of special equipment to see the yogic effects on human body and mind in an amplified form. In the present study, resting heart rate, electro dermal response (GSR), reaction time (simple visual and choice visual), hand steadiness, and eye hand coordination parameters were measured in the yoga practicing groups comprising of young male and female participants (N=40, Males=20, females=20) in the age group of 19 to 22 years to see the differences between males and females on these parameters. The females were superior to males in choice visual reaction time. There were no significant differences between male and female yoga practitioners with regard to their simple visual reaction i.e. when the single stimulus was being presented. Also there was no significant difference on hand steadiness between males and females.</i> |
| Keywords | <i>Resting heart rate, electro dermal response, reaction time, hand steadiness, eye hand coordination</i> |

INTRODUCTION

The psychological and physiological aspects of humans are so closely interwoven that the problem of psycho-physiological or psychosomatic disorders must be considered with attention to both aspects. Many physiological changes are induced while we respond to stress, tension, anxiety and arousal in our lives: sweating, blushing, gooseflesh, sexual arousal, weeping, the feeling of a 'lump in the throat' etc. It is obvious then, that when someone has a physical illness there are profound concomitant psychological factors that can materially affect the physiological factors. Psycho-physiology has emerged as a sub field of psychology and medicine that studies the relationship between mental activity and physiological functions. In other words, it investigates the mind-body connection in a scientific way. Professionals have been using the psycho-physiological approach in the training and rehabilitation of healthy and chronically ill persons. It is neither feasible nor ethical to compare men and women on physical correlates of sports performance, but yes certain parameters are worth studying as done in the present study in order to get further insight into performance prognosis and training techniques by coaches and trainers.

Psycho-physiological disorders thus affect many parts of the body, but certain organs and tissues seem more vulnerable than others. The digestive system, for example, is frequently beset by disorders that are psycho-physiological. Muscle cramps, recurrent stiff necks, backaches, and tension headaches are other common complaints, which may be reported by the patients in stressful situations. Psycho physiologists are thus interested in how mental characteristics affect the body. How does the person experience information from his/her body, exactly what happens when people experience particular emotions etc. Applied psycho-physiology is the discipline, which uses this information for practical purposes For example, psycho physiologists do research to find new ways to teach sports person better ways to learn to control body functions which may be causing performance deterioration or health problems and they also study ways to predict and prevent stress related problems of sports persons (Horn, T.E., Ed. 1992).

Thus it can be said that as researches continue to support the role of yoga in building and maintaining health, people in general are also interested in learning how they can apply related information to build skills and enjoy their activities more fully. These individuals become likely subjects for psychologists seeking to improve upon, promote healthy habits and prevent health related disorders.

PROCEDURE

Random purposive sampling technique was used for sample collection. The yoga practicing groups from various yoga centres of Delhi state, comprising of young male and female participants (N=40, Males=20, females=20) in the age group of 19 to 22 years were tested to see the differences between males and females on resting heart rate, electro dermal response (GSR), reaction time (simple visual and choice visual), hand steadiness, and eye hand coordination parameters.

A. Yoga training: Following yogic techniques were daily practiced. • SukshmaVyayam (minor exercise) 3 minutes • SthulaVyayama (macro/major exercise) 3 minutes • Pranayam 5 minutes o Nadishodhan o Bhramari • Asanas (postures): 20 minutes o Suryanamaskar o Urdhvahastottasan o Katichakrasan o Konasan o Paschimottanasan o Vajrasan o Mandukasan o Gaumukhasan o Ardhamatsyendrasan o Padmasan o Dhanurasan o Bhujangasan • Shavasan: 2 minutes • Dhyana (meditation): 7 minutes “Om” chanting (2 minutes)-Total 42-45 minutes session. Unanimity, regularity and uniformity was ensured after discussion with the qualified yoga trainers of respective centres.

B. The testing of subjects was carried out for 6 weeks (5 days a week) at different yoga centers in Delhi and NCR. Following procedure was used for recording the responses-

- i. **Reaction time** - The reaction time measured in the present study was Simple Visual Reaction Time (SVRT) and the choice visual reaction time (CVRT). The reaction time is the time between the end of stimulus presentation and onset of the response. The most -fundamental situation is one in which a single stimulus results in a single response and time taken to respond is known as Simple Visual Reaction Time. The situation where one has to produce a particular response in relation to a given set of stimuli or sequence of stimuli gives rise to what is known as the choice or complex visual reaction time. The room where the visual reaction time was measured was neat & clean & there were no any disturbing sounds or glaring lights. The subject sat comfortably in front of the tester. The machine has two partitions separated by a black screen. The subject sat close to the machine. The subject’s side has got three lights viz. yellow green and red and their corresponding switches. The tester presses the reset button in his side to make all the readings on the digital panel meter, “zero”. The sports person was explained about the switches to be pressed in response to one visual stimulus first and then to different types of visual stimuli. As soon as the person sees the light glow, she/he presses the button to switch the same light “off”. For measuring Simple Visual Reaction Time only one type of stimuli is to be selected and the subject is clearly told to press a particular switch in response to the stimulus. For measuring complex/choice visual reaction time (CVRT), three types of stimuli are selected and the subject has to press the corresponding button only to switch off that particular light which is glowing. The total number of readings taken for both SVRT & CVRT was five each. The time taken in responding was displayed on the digital display, which was present on the side of the tester. Both Simple Visual and Complex Visual Reaction time are measured in milli-seconds. Each subject was given 5 attempts and three trials. The final reading was the average of three trials.
- ii. **Resting heart rate monitoring** - The room, where pulse biofeedback monitor was kept was neat and clean and there was not any disturbing sound and glaring lights. The subject lied down in a comfortable position. The sports person should not have performed any vigorous exercise just before the testing. The highly sensitive transducers were wrapped on the tip of the person’s fingers with the help of a Velcro tape. The subject was told to relax as much as possible on his own, keeping his eyes closed. The subject was told to stay still while his heart rate is monitored. The digital pane meter displayed the resting heart rate. The heart rate was measured in beats /min.
- iii. **Galvanic skin response (GSR)/ Electro dermal response (EDR)** - The room, where the GSR monitor was kept was neat and clean and there was not any disturbing sound and glaring lights .The person lies in a comfortable position. The machine was kept in the “off” mode. The electrodes are placed on the fingertips of the subject by means of Velcro tape. Jelly was applied on the two electrodes to increase the sensitivity of the electrodes. The machine was switched on. The electronic meter displayed the GSR value of the subject in Kilo-ohms.
- iv. **Anticipation Time** - The subject sat 2-3 feet away from the target lamp. The distance from the target lamp was kept constant. Subjects had to press the stylus button for their push button

response as soon as the light travelling on the rectangular metal pipe reaches the last light emitting diode (L.E.D.).

The runway speed was set to 3 mph.

- Select the warning light fore period at 3 seconds.
- Press RESET to prepare for a new trial.
- Press START to initiate a trial. After the fore period warning interval passes, the light sequence was travelling down the runway.

Each phase of trial was indicated by the special indicator lamps i.e. WARNING, RUN, FINISH, RESPONSE, special lamps, EARLY & LATE, indicated the direction of the subject's error. The tester resets the apparatus after each response. The digital L.E.D. timer indicates the early or late response duration. Each person was given three trials of 5 responses and the average value of all the three trials was recorded.

v. **Hand steadiness testing** - The subject sat comfortably in front of the tester. Initially the subject was told to insert the metal stylus into the hole number V of the metal plate. The instrument has been designed to measure one aspect of the psychomotor phenomena of steadiness. The subject's aim was to hold the stylus in the hole without touching the side for duration of 30 seconds and the errors within the stipulated time were recorded digitally. Each subject was given three trials on each hole and the average of the three trials was recorded.

RESULTS AND DISCUSSION

Descriptive statistics using explore option in SPSS 20 version was being computed for all the variables (N=40) and then separately for men (N=20) and women (N=20).

The Shapiro-Wilk test used for analyzing the normality of all the variables of data shows **Sig.** value under the Shapiro-Wilk column was found to be greater than 0.05. We can conclude that "overall" for all the individuals it is normally distributed. The same data from the same individuals but separately for men and women was also being analyzed to produce a Normal Q-Q Plot and Shapiro-Wilk column. It was concluded that the data appears to be normally distributed as it follows the diagonal line closely and does not appear to have a non-linear pattern. **Sig.** value under the Shapiro-Wilk column was again found to be greater than 0.05. We can conclude that after splitting the data into men and women still it is normally distributed.

Table-1: One sample t-test for the group of 40 yoga practitioners (combined) on their respective test values

| Variable | M | SD | Test value | t (difference) | df | Sig. (2-tailed) | Interpretation |
|--|--------|-------|------------|----------------|-------|-----------------|-----------------|
| SIMPLE VISUAL REACTION TIME (in milli-seconds) | 205.33 | 33.39 | 250.00 | -8.46* | 39.00 | 0.00 | Significant |
| CHOICE VISUAL REACTION TIME (in milli-seconds) | 244.48 | 33.02 | 280.00 | -6.81* | 39.00 | 0.00 | Significant |
| RESTING HEART RATE (in beats /minute) | 73.10 | 4.79 | 72.00 | 1.45 | 39.00 | 0.16 | Not Significant |
| ELECTRODERMAL RESPONSE (in Kilo-ohms) | 282.58 | 52.65 | 500.00 | -26.12* | 39.00 | 0.00 | Significant |
| No. of early res (scale) | 9.63 | 2.56 | 8.00 | 4.00* | 39.00 | 0.00 | Significant |
| No. of Late res (scale) | 8.63 | 2.08 | 8.00 | 1.90 | 39.00 | 0.07 | Not Significant |
| No. of errors in 5th hole (scale) | 10.88 | 1.96 | 5.00 | 18.92* | 39.00 | 0.00 | Significant |

*value is significant at .05 level.

Table-1 shows that there was significant difference in all the variables upon the test values except resting heart rate and number of late responses. We can say that the deviation was significant for all but one variable from the normal values as recorded for the sportspersons in the past. It can be therefore concluded that overall the group of 40 yoga practitioners was found to be inferior (if the term is acceptable) in all the 6 psycho-physiological variables than the sports persons average test values except in the number of late responses variable.

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| SIMPLE VISUAL REACTION TIME values for both the males and females combined together were significantly higher than the test value (avg. 250 milli-seconds). | Therefore null hypothesis that there will not be significant differences between the test value and the overall computed value of 40 yoga practitioners is rejected at 5% level (p<.05). |
| Similar trend was being observed for CHOICE VISUAL REACTION TIME (test value was 280 milli-seconds). | Therefore null hypothesis that there will not be significant differences between the test value and the overall computed |

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| | value of 40 yoga practitioners is rejected at 5% level (p<.05). |
| RESTING HEART RATE was found to be not statistically significantly higher than the test value of 72 beats/min for the males (M=70.41, SD 4.79) | Therefore null hypothesis that there will not be significant differences between the test value and the heart rate value of male yoga practitioners is accepted at 5% level (p>.05). |
| Electrodermal values of male and female practitioners combined together were found to be significantly lower than the normal (500 kilo-ohms) value. | Therefore null hypothesis that there will not be significant differences between the test value and the overall computed value of 40 yoga practitioners is rejected at 5% level (p<.05). |
| Number of early responses for males and females combined together was significantly higher than the normal values (maximum test values of 8 errors in 10 attempts). | Therefore null hypothesis that there will not be significant differences between the test value and the overall computed value of 40 yoga practitioners is rejected at 5% level (p<.05). |
| Number of late responses for males and females combined together was not significantly higher than the normal values (maximum test values of 8 errors in 10 attempts). | Therefore null hypothesis that there will not be significant differences between the test value and the overall computed value of 40 yoga practitioners is accepted at 5% level (p>.05). |
| Number of errors in 5th hole (measure of hand steadiness) was found to be statistically significantly higher than the test value of 5 errors for the males as well as females. | Therefore null hypothesis that there will not be significant differences between the test value and the overall computed value of 40 yoga practitioners is rejected at 5% level (p<.05). |

Table-2: Gender wise Group Statistics showing mean, standard deviation, and standard error mean

| Gender | | N | Mean | Std. Deviation | Std. Error Mean |
|-----------------------------|--------|----|--------|----------------|-----------------|
| Experience in years | male | 20 | 1.50 | 0.51 | 0.11 |
| | female | 20 | 1.55 | 0.51 | 0.11 |
| Age | male | 20 | 20.45 | 1.05 | 0.23 |
| | female | 20 | 20.00 | 1.17 | 0.26 |
| SIMPLE VISUAL REACTION TIME | male | 20 | 215.05 | 25.50 | 5.70 |
| | female | 20 | 195.60 | 37.93 | 8.48 |
| CHOICE VISUAL REACTION TIME | male | 20 | 259.25 | 27.07 | 6.05 |
| | female | 20 | 229.70 | 32.32 | 7.23 |
| RESTING HEART RATE | male | 20 | 70.40 | 4.79 | 1.07 |
| | female | 20 | 75.80 | 2.97 | 0.66 |
| ELECTRODERMAL RESPONSE | male | 20 | 318.70 | 34.97 | 7.82 |
| | female | 20 | 246.45 | 41.46 | 9.27 |
| NO_OF_Early_resp | male | 20 | 8.10 | 2.02 | 0.45 |
| | female | 20 | 11.15 | 2.13 | 0.48 |
| NO_OF_Late_resp | male | 20 | 7.80 | 1.88 | 0.42 |
| | female | 20 | 9.45 | 1.99 | 0.44 |
| No_of_errors_in_5th_Hole | male | 20 | 10.30 | 2.13 | 0.48 |
| | female | 20 | 11.45 | 1.64 | 0.37 |

Table-2 shows mean, standard deviation and standard error of the mean for male and female yoga practitioners. The mean values of females on SIMPLE VISUAL REACTION TIME, CHOICE VISUAL REACTION TIME was in the lower side (lower the better) in comparison with that of males. The resting heart rate was lower in males. Electrodermal response was on higher side in males. Number of early and late responses as also number of errors committed in the fifth hole was lower in males as compared to that of females. However, whether this difference is significant or not was being further tested by using two-sample independent t- test for the two unrelated groups.

One of the conditions for using the two-sample t-ratio for unrelated groups is that the variances of the two groups must be equal. Levene’s test was used to test the equality of variances.

Table-3: Group statistics showing mean, standard deviation, mean difference, standard error difference, t-value, Levene’s test of equality of variances

| Gender | Mean | Std. Dev | Mean Diff | Std. Error Diff | t value | p-value/ Sig. (2-tailed) | Levene's Test for Equality of Variances |
|--------|------|----------|-----------|-----------------|---------|--------------------------|---|
|--------|------|----------|-----------|-----------------|---------|--------------------------|---|

| | | | | | | | | f-value | p-value |
|-----------------------------|--------|--------|-------|-------|-------|--------|------|---------|---------|
| Experience in years | male | 1.50 | 0.51 | -.05 | .16 | -.309 | .759 | .192 | .664 |
| | female | 1.55 | 0.51 | | | | | | |
| Age | male | 20.45 | 1.05 | .4500 | .35 | 1.280 | .208 | .001 | .980 |
| | female | 20.00 | 1.17 | | | | | | |
| SIMPLE VISUAL REACTION TIME | male | 215.05 | 25.50 | 19.45 | 10.21 | 1.903 | .065 | 1.669 | .204 |
| | female | 195.60 | 37.93 | | | | | | |
| CHOICE VISUAL REACTION TIME | male | 259.25 | 27.07 | 29.55 | 9.42 | 3.134 | .003 | .184 | .670 |
| | female | 229.70 | 32.32 | | | | | | |
| RESTING HEART RATE | male | 70.40 | 4.79 | -5.40 | 1.26 | -4.283 | .000 | 1.935 | .172 |
| | female | 75.80 | 2.97 | | | | | | |
| ELECTRODERMAL RESPONSE | male | 318.70 | 34.97 | 72.25 | 12.12 | 5.957 | .000 | .000 | .986 |
| | female | 246.45 | 41.46 | | | | | | |
| NO_OF_Early_resp | male | 8.10 | 2.02 | -3.05 | .65 | -4.638 | .000 | .158 | .694 |
| | female | 11.15 | 2.13 | | | | | | |
| NO_OF_Late_resp | male | 7.80 | 1.88 | -1.65 | .61 | -2.698 | .010 | .071 | .791 |
| | female | 9.45 | 1.99 | | | | | | |
| No_of_errors_in_5th_Hole | Male | 10.30 | 2.13 | -1.15 | .60 | -1.914 | .063 | .432 | .515 |
| | female | 11.45 | 1.64 | | | | | | |

In the table-3, F-value is not significant for any of the 9 variables as the p-value is greater than .05 for all. Thus the null hypothesis of equality of variances may be accepted and it is concluded that the variances of the two groups are equal. Aditya Jain et.al. (2015) in their study entitled “A comparative study of visual and auditory reaction times on the basis of gender and physical activity levels of medical first year students” found that male medical students have faster RTs as compared to female medical students for both auditory as well as visual stimuli. Regularly exercising medical students have faster RTs when compared with medical students with sedentary lifestyles.

Contrary to the findings of our study, a review of the literature on the influence of gender on reaction time shows that in almost every age group, males have faster reaction times as compared to females, and female disadvantage is not reduced by practice (Noble et. al., 1964, Adam JJ et. al, 1999, Der G. et. al., 2006). Researches done by Misra et al.(2006) also showed that males responded faster than females. The male-female difference is due to the lag between the presentation of the stimulus and the beginning of muscle contraction. Nowadays the male advantage is getting smaller, possibly because more women are participating in driving and fast-action sports (Silverman IW, 2006). It was found in the present study (Table-3) that there were non-significant differences amongst regularly exercising male and female participants on Simple Visual Reaction Time.

It can be seen from the table that the value of t-statistics is not significant for:

- a. Number of years of experience
- b. Age
- c. SIMPLE VISUAL REACTION TIME
- d. Number of errors committed while holding the stylus in 5th hole for 30 seconds.

Thus the null hypothesis of equality of population means of two groups is accepted for above four variables and on the basis of present study’s findings, it may be concluded that there is no significant differences between the males and females on SIMPLE VISUAL REACTION TIME and number of errors in 5th hole.

It can be seen from the table that the value of t-statistics is significant (at .05 level) for:

- a. Choice visual reaction time
- b. Resting heart rate
- c. Electro dermal response
- d. Number of early responses
- e. Number of late responses

Thus the null hypothesis of equality of population means of two groups is rejected for above five variables and it may be concluded that there is significant difference between the males and females on choice visual reaction time, resting heart rate, electrodermal response, number of early and number of late responses.

CONCLUSION

This study found that the female participants had statistically significantly lower CHOICE VISUAL REACTION TIME (229.70 ± 35.32 milli-seconds) compared to male yoga practitioners (259.25 ±

27.07milli-seconds), $t(38) = 3.13, p = 0.003$. So the females were superior to males in choice visual reaction time. Male participants had statistically significantly lower RESTING HEART RATE (70.40 ± 4.79 beats per minute) compared to female yoga practitioners (75.80 ± 2.97 beats per minute), $t(38) = 4.28, p = 0.000$. It can be said that the males were fitter than females. Male participants had statistically significantly higher ELECTRODERMAL RESPONSE (318.70 ± 34.97 kilo-ohms) compared to female yoga practitioners (246.45 ± 41.46 kilo-ohms), $t(38) = 5.95, p = 0.000$. It can be said that the males were more relaxed, calm and peaceful than females. Male participants had statistically significantly lesser no. of early responses (8.10 ± 2.02) compared to female yoga practitioners (11.15 ± 2.13), $t(38) = 4.63, p = 0.000$. It can be said that the males were less over aroused than females. Male participants had statistically significantly lesser no. of late responses (7.80 ± 1.88) compared to female yoga practitioners (9.45 ± 1.99), $t(38) = 2.69, p = 0.01$. It can be said that the males were less under aroused than females.

There were no significant differences between male and female yoga practitioners with regard to their reaction times when the single stimulus was being presented to the two groups. Also there was no significant difference on hand steadiness between males and females. Upon extensive literature search, it was found that there are no randomized prospective studies comparing other than reaction time variables among male and female yoga practitioners.

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