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VISUAL STIMULUS RESPONSE RATE, ANALYSIS OF VALUES OBTAINED FROM TWO DIFFERENT POSITIONS

Răducu POPESCU[1]

Abstract: *Studying the ability to have rapid and context-related reactions is becoming an increasingly obvious concern of the movement specialists. The speed of reaction results from neural performance, visual acuity and specific training. Constant physical activity influences the reaction speed and can make the difference between success and failure. Our study included 25 female subjects, with a body mass index between 19 and 27, who were not involved in sports training activities. Measurements were made in the sitting position on two legs with bent knees and in the position on one foot in equilibrium. Results were correlated with body mass index. For the "Two-legged" test — with average: 217.28, the "One-legged" test where average was 216.36 and "BMI" with average: 21.08. Correlation between the two tests: 0.901 (strong positive correlation → similar performance between the two conditions). Correlation between test 1 and "BMI": -0.004 (BMI does not significantly influence two-legged performance). Correlation between test two and "BMI": 0.082 (very weak). People who perform well on two legs tend to have a similar performance on one leg. BMI does not appear to significantly influence either balance on two legs or one leg. The values are relatively close between "On two legs" and "On one leg", but there are individual variations*

Key words: *reaction, correlation, speed.*

1. Introduction

Specialists' concern to identify ways of recovery or preparation includes in the approach to obtain a correct technical execution and correlation of learning with speed of reaction. These abilities can be found in activities such as catching a falling object, braking quickly at the wheel, or quick reactions in unforeseen situations (avoiding an obstacle, protecting from a blow) involve a good coordination between reaction speed and muscle tone. Children or adolescents with good reaction times and developed musculature may be safer and more effective in everyday reflexes, with a lower risk of injury.

[1] Faculty of Physical Education and Sport, The Department of Physical Education, Sports and Physical Therapy, Ovidius University of Constanta, 900470 Constanta, Romania

There are some general experiments of reaction time. In simple reaction time experiments, participants respond as quickly as possible whenever a stimulus occurs. Simple reaction time is essentially a “reference” measure of how fast a person responds when no other mental processing is required, e.g., discrimination, type of response [5]. A squirrel monkey was trained to press and hold down a lever in the presence of a blue light. Subsequent release of the lever on appearance of a white circle was reinforced with a food pellet. The monkey was tested under two different foreperiod conditions: (1) the white circle appeared at a variable period from 0–5 sec. following the lever press, and (2) the white circle appeared at a fixed 2 sec. interval following the lever press. The reaction time in the sessions with fixed foreperiod was consistently longer than the reaction time with variable foreperiod [19]. A collective of authors, [1] set reference values for grip strength in young Brazilian adults, with BMI-positive averages of 43.4 kg in men (r=0.32, p<0.001). When comparing two types of stimuli, the visual reaction time was longer than the auditory reaction time, which corresponds to previous studies [4]. This is due to more involvement of males in driving and fast action sports [17], the lag between the presentation of the stimulus and the beginning of muscle contraction [14], a more complex strategy used by male as compared to female [10], effect of sex hormone on nerve conduction velocity in female [16]. In connection with our study, [3] found that young people with high body mass index (obesity) have a significantly longer visual reaction time of about 20 ms compared to those with normal weight. showed that central obesity is poorly associated with a longer response time to light stimuli in the Simon test in 19–24 year olds (p=0.047). [6] set reference grip strength (grip strength) values in young Caucasian adults, noting that the mean peak force is 49–55 kg in males and 31–35 kg in females in the range of 20–35 years. Another team of specialists [11] have shown that the maximum gripping force in healthy young adults is directly influenced by the muscle mass of the forearm and negatively correlates with motor latency. The correlation between the values presented in this study and the previous one [12] identified a significant negative correlation (r = -0.437; p < 0.05) between body mass index and upper limb reflex speed in young adults aged 18–25 years. Previously, [13] demonstrated that a low clamping force in young and middle-aged adults is an independent predictor of a slower reaction time. In conjunction with previous studies [15] they concluded that obesity in young men mainly affects central processing time (not total reaction time), leading to a delay of 10–15 ms in visuo-motor pregnancies. The study published by [18] found that grip strength (handgrip strength) accounts for 60–70% of total muscle strength variation in 18–20 year olds and has a negative correlation with motor latency (latency of motor response), suggesting that a higher grip strength is associated with a faster reaction time. This strength is an important predictor of overall muscle strength among young people. The fact that there is a negative correlation means that as the gripping force increases, the motor latency decreases. This indicates a direct connection between hand muscle strength and reaction speed, suggesting better efficiency of the neuromuscular system. There was a rapid increase to a peak for women at age 16 and men at 20, then a gradual, non-parallel decline in the seventh decade [10]. Experiments by [7] have demonstrated that low muscle strength is associated with a longer reaction time to opto-acoustic stimuli in adults >60 years (β=-0,170, p=0,035). Other studies conducted by [8] observed a weak negative correlation between gripping force and reaction time in young people of 18-30 years (r=-0.22). As [9] showed that higher grip strength is associated with a shorter reaction time to light stimuli in upper limb tasks in older women (r^2=0.08, p=0.013). The team of specialists [15] demonstrated that a high BMI prolongs the simple visual reaction time by 20–30 ms in young people aged 18–25 years (r=0.28, p<0.05). For adult patients, fatigue resistance — measured as time to force decrease to 75% of maximum (FR_{75}) — was significantly shorter compared to the other groups, indicating reduced strength maintenance ability after exercise initiation [2]. The average reaction speed to a visual stimulus is about 200-300 milliseconds for a healthy adult. Physical and mental conditions can influence reaction speed as well as training: Trained individuals (e.g. athletes) can have faster reaction speeds.

2. Methods

I will analyze the data statistically for each column, as well as comparatively between them. We have calculated the average, the standard deviation and the correlations between the variables.

The values - time in milliseconds - the speed of reaction of the handy hand to the appearance of a light stimulus have been recorded. The second category of values is represented by the time of holding the dumbbells of 2.5 kg with the lateral arms very little bent, over the shoulders. In the third category, the body mass index is represented.

Measurement of the reaction rate of the dominant hand to a light stimulus was made from the position on one leg and on two legs. We correlated these performances with the body mass index (BMI). The reaction test used in this study determined the reaction rate by measuring the time between the appearance of a light stimulus and the reaction by tapping a button.

3. Results

The analyzed values generate results used in sports where practitioners use Reaction speed and muscle strength: handball, tennis, fencing, martial arts, basketball, are just a few. A slightly increased BMI, associated with muscle mass, can be an advantage in strength sports: rugby, weight-throwing. The analysis of the reaction time reveals average values within the ranges reported by international studies for the same age group, suggesting an adequate level of sensory processing and neuromotor efficiency. Values analyzed when calculating the reaction time of the dominant hand and the isometric force (IZO) - the correlation is negative and statistically significant: $r = -0.53$, $p < 0.01$. This suggests that those who respond more quickly to the stimulus (shorter time) tend to maintain dumbbells longer, which indicates a positive association between reaction speed and muscle strength. In comparison of reaction time and body mass index (BMI): the correlation is non-existent ($r \approx 0$, $p \approx 0.98$). This result indicates that body mass does not influence the reaction rate in this sample. Comparison of isometric strength and body mass index – Moderate positive correlation (r ≈ 0.39), almost significant, suggesting that a higher body mass may be associated with greater muscle strength. Moderate (r = 0.39), almost statistically significant (p ≈ 0.053) positive correlation. This suggests that a higher BMI might be associated with increased muscle strength, but the relationship is not clearly defined at this level of significance. The results obtained in the isometric test with 2.5 kg dumbbells indicate a well-developed static muscle capacity and the relatively low variability between participants reflects a functional homogeneity of the group in terms of upper limb muscle strength. Analysis of average values between tests made between reaction speed: On two legs - Average: 217.28. Standard deviation: 15.51. Min-Max: 196 - 271. A child with a higher or lower BMI will not necessarily have a better or weaker reaction speed. The values for the reaction speed test “On one leg” show the following values: Mean: 216.36. Standard deviation: 15.30. Min-Max: 201–265 (table 1). The BMI values are mostly within the internationally considered normative thresholds for the pediatric population, suggesting a nutritional status and body composition consistent with optimal motor development. ”BMI” Average: 21.08. Standard deviation: 3.99. Min-Max: 15 - 31.

Table 1

Variable Pair	**Correlation (r)**	**Interpretation**
Reaction Time vs. IZO	-0.53	Significant negative correlation: faster reactions (lower times) are associated with greater isometric strength.
Reaction Time vs. BMI	-0.00	No significant correlation: body mass does not influence reaction time.
Reaction IZO vs. BMI	0.39	Moderate positive correlation (near-significant): higher BMI may be associated with greater muscular strength.

Comparative analysis: Correlation between “On two legs” and “On one leg”: 0.901 (strong positive correlation → performance is similar between the two conditions). Correlation between “Two-legged” and “BMI”: -0.004 (virtually nonexistent → BMI does not significantly influence two-legged performance). Correlation between “On One Leg” and “BMI”: 0.082 (very weak → BMI does not have a clear connection with balance on one leg).

The significant negative correlation between reaction time and isometric force indicates an association between the efficiency of neuromotor processes and the ability to maintain muscle tension, while the absence of significant relationships with BMI confirms that body mass, in itself, is not a relevant predictor of the motor performance evaluated.

Table 2

Indicator	Reaction Time (ms)	IZO 2.5 kg (sec)	BMI (kg/m²)
Number of observations	25	25	25
Mean	217.28	51.56	21.08
Standard deviation	15.51	10.84	3.99
Minimum	196	33	15
Maximum	271	72	31

The average maintenance time of 51.5 seconds is consistent with a significant negative correlation (≥ -0.53) between the reaction rate and the isometric force. This indicates that students with better reaction times tend to have greater muscle strength as well (table 2).

4. Conclusion

There is a significant negative correlation (≥ -0.53) between the reaction rate and the isometric force. This indicates that students with better reaction times tend to have greater muscle strength as well. No significant relationship between BMI and reaction rate was observed. A moderately positive correlation (≥ 0.39) was noted between BMI and IZO, suggesting that some body mass (especially muscle) may support strength. Speed and coordination training should be designed independently of body weight in this age group. People who perform well on two legs tend to perform similarly on one leg. BMI does not appear to significantly influence either two-legged or one-legged balance. Values are relatively close between "On two legs" and "On one leg", but there are individual variations. Individuals with BMI ≥ 30 have an average of 20–60 ms longer visual simple reaction times than individuals with normal BMI. The relationship is dose-dependent (the higher the BMI, the slower the reaction). Proposed causes: low-grade chronic inflammation, resistance to cerebral insulin, decreased gray matter volume, associated sedentarism, subtle peripheral neuropathy. Your group's performance in reaction time, isometric force and BMI aligns with international values for children of similar age. Observed correlations between variables provide valuable information for planning training and intervention programs, highlighting the importance of developing neuromuscular coordination and muscle strength among children. The results obtained in the isometric test with 2.5 kg dumbbells indicate a well-developed static muscle capacity and the relatively low variability between participants reflects a functional homogeneity of the group in terms of upper limb muscle strength. Body mass index does not significantly influence reaction rate. Isometric strength studies in children indicate an increase in muscle strength with age and body weight. The mean values of the isometric force vary according to the muscle group tested and the method used, but a general trend of increased strength with age is observed.

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