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Body Proportions and the Results of the Toe-Touch Test

by

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Flexibility is often defined as the range of motion of a single joint or several joints. The "toe-touch" test (TTT) is one of the most popular clinical tests evaluating the level of flexibility. The objective of the study was to determine the relationships between results of the TTT and selected length indexes of the human body. 284 adults were selected for the experiment. The first group of linear, anthropometric measurements were related to the lengths of the lower and upper extremity, the trunk, as well as the head together with the neck. As soon as the measurements were taken the TTT was performed. The results did not show any significant relationships between the outcome of the TTT and all length variables, as well as the majority of calculated body indexes. The only exception appears in case of the head and height index, where weak, but significant relationships exist.

Key Words: *flexibility, 'toe-touch' test, range of motion*

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Introduction

The 'toe-touch' test (TTT), also called the Thomayer's test, constitutes a frequently utilised tool both individually in frames of physiotherapy and as a part of batteries of motor tests that aim to evaluate the level of flexibility. Flexibility itself is most often defined as the range of motion of one or several joints (Bandy 1997; Kokkonen 1998; Magnusson 1998; Bober 2001; Funk 2001; Nelson 2001; Osinski 2003). This ability seems to be of great importance in human physical fitness. The Concept of Health-Related Fitness, according to Bouchard & Shepard (Osinski 2003), classifies it as a morphological component, however in works of Skinner & Oja it is categorized as a muscular and skeletal component (Osinski 2003).

The TTT is used as an indicator of total body flexibility. As stated by Swiderski *et al.*, (1973): 'limitation of flexibility appears as the first symptom of dysfunction, preceding either pain or insufficiency, or both'. The outcome of the TTT creates an important motivating factor at the same time. The subject notices his/her shortcomings and may start a flexibility training program. This allows to place the TTT among the group of heterotelic tests as well. The result may also facilitate identification of the cause of flexibility limitation. Li *et al.*, (1996) showed that results of the TTT are correlated with ranges of motion of the spine and hip joints. Similar observations were made by Kuszewski *et al.*, (2004), who also noticed that the results of this test are dependent on the length and elasticity of posterior structures of the thigh. The mentioned test does not constitute the only tool for quantifying flexibility, but simple and easy application are still the main causes of its frequent utilization.

The 'toe-touch' test gives the possibility to evaluate individual structures of the human motor system in a functional way and thanks to this feature is often applied in the field of physiotherapy (Magnusson et al., 1997; Gajdosik et al., 1994). On the other hand, it describes one of the components of overall fitness, and therefore such testing procedures as International Fitness Test, Fitness Index by Zachora or Test Battery for Adult's Fitness by Association for Promoting Physical Education take advantage of it.

Flexibility is an important factor influencing health and quality of life. Therefore it is crucial for tests serving this purpose to be valid and precise.

The aim of the study was to assess the relationships between results of the TTT and selected length variables of the human body.

Material and methods

284 adult subjects. 146 women (51.4%) and 138 men (48.6%), were selected for the experiment. None of the subjects indicated signs of any ailment arising within the motor system both during measurements and directly preceding them. The average body mass and height were 67.4 ± 11.9 kg and 172.8 ± 8.5 cm respectively. Average age of the subjects was 25.19 ± 6.9 years. On average women were younger then men (respectively 24.62 ± 6.23 and 25.79 ± 7.55 years). The anthropometric measurements were taken with a non-elastic medical tape. During the evaluations subjects stood barefoot in the neutral anatomic position. The precision of measure equalled 0.5 cm. The first measurement included the length of the lower extremity, from the greater trochanter (tro) to the ground (B). The upper limbs were measured from acromion (a) to the tip of the third finger (da), the trunk from the pubic symphysis (sy) to the jugular notch (sst) and the head together with neck (the Frankfurt position) from the top of the head (v) to the spinous process of C7 vertebrae (c). During the last measurement, to avoid bends of the tape on the surface of the skull a spirit level was placed on the top of the head and the outcome was recorded as the perpendicular distance from the line created such way and C7. Body height of the body was also taken. Using the basic anthropometric variables the following indexes were calculated:

- extremity index –length of upper extremities (left & right) to length of lower extremities
- trunk and extremity index I –length of upper extremities (left & right) to trunk length;
- height and extremity index I –length of upper extremities (left & right) to body height;
- trunk and extremity index II –length of lower extremities (left & right) to trunk length;
- height and extremity index II –length of lower extremities (left & right) to body height;
- head and trunk index –length of head and neck to trunk length;
- head and height index –length of head and neck to body length;
- trunk and height index –length of trunk to body length.

As soon as the linear anthropometric measurements were taken the TTT was performed. The subject was standing barefoot on the small platform with his/her toes placed on its edge, then was instructed to perform a deep forward bend keeping knees straight (fig.1.). The distance from the tip of the third finger (da) to the surface of the platform was recorded. The result was recorded as a negative value if the subject was not able to reach the surface, otherwise the

result had a positive value. The TTT was performed three times and the best performance was recorded.

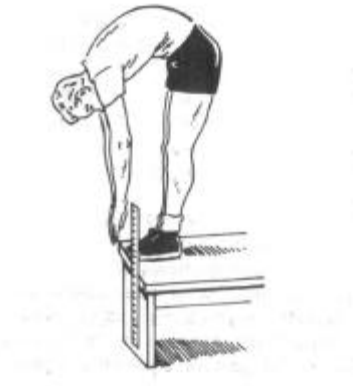

Fig. 1

The "toe-touch" test (Slezynski 1991).

All the results obtained were subjected to statistical analysis with the use of Statistica 5.0 software. Pearson's correlation coefficients were calculated between the results of the TTT and linear measurements as well as body indexes.

Results

The results do not show any significant relationships between the outcome of the TTT and length variables (Tab.1.) as well as the majority of calculated body indexes (Tab.2.). The only exception from this rule appears in case of the head and height index, where a weak, but a significant correlation was found (Tab.2).

Table 1

Pearson's correlation coefficients between the results of the TTT and length variables.

Variable	**Correlation coefficients and the level of significance**
lower extremity	r = -.031 p = .605
upper extremity	r = -.063 p = .288
trunk	r = .044 p = .460
head and neck	r = .110 p = .064

* - statistically significant

Table 2

Pearson's correlation coefficients between the results of the TTT and body indexes.

Index	Correlation coefficients and level of significance
extremity	r = -.076 p =.202
extremity and height I	r = -.052 p = .380
extremity and trunk I	r = -.109 p = .066
extremity and height II	r = .028 p = .635
extremity and trunk II	r = -.074 p = .214
trunk and height	r = .111 p = .062
head and trunk	r = .071 p = .234
head and height	r = .171 p = .004*

* - statistically significant

Discussion

Valid and precise evaluation of flexibility is of great importance both in the field of physiotherapy and physical education. Flexibility has recently gained significant scientific attention, especially that lower back pain has become a common aliment (Johnston *et al.*, 2003, Swiderski 1973 Marciniak 1990; McGill 1998, Dziak 1997; Frymoyer 1987; Riihimaki 1991). Flexibility may be treated as a resultant of range of motion of individual joints, however this approach and evaluation techniques have significant shortcomings. First of all it takes quite a long time to measure the flexibility in several joints and therefore produces fatigue of the subject. Secondly – information concerning global flexibility is still lacking. In the end the human body creates a functional unity, and only a global view is most valuable and may provide complete information about it. For this purpose a valid and precise, simple tool serving the purpose of flexibility evaluation is desirable. When evaluating mobility the applied test should not be influenced by proportions of the body. The TTT shows a significant relationship with the range of motion of the spine and hip joints as well as functional length of the hamstrings (Li *et al.*, 1996; Kuszewski *et al.*, 2004). It seems reasonable to perceive it as a global flexibility test. At the same time some doubts concerning population bias may arise. The basic assumption is that the test favours subjects with longer upper and shorter lower limbs (Borms 1984). Different conclusions were made by Broer'a *et al.*, (1958). In a group of 100 young, physically active women they showed that the outcome of the TTT is not dependent on length variables. Only in unproportionally built subjects (long arms and short legs) the results do not go along with the level of flexibility. It seems that low number of

subjects and female-based population create further bias of this study what makes it impossible to finally solve the argument. The results of this study are in accordance with Borer *et al.*,

On the other hand, it is worth noticing that performing the TTT with its deep-forward-bend position can escalate lumbar pain and is not suggested for the elderly. The conducted research add to the validity of the TTT. The body proportions considered in this study do not significantly influence the results of TTT.

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