ASSOCIATIONS OF THE BODY TYPES AND DISEASE RELATED VALUES OF KNEE OSTEOARTHRITIC PATIENTS

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ABSTRACT

Different spa therapy courses are offered for treating knee osteoarthritis (OA) in Estonian medical spas. They contain approximately six daily sessions of three different treatments: massages, thermotherapies, kinesitherapies etc. There are some disease related risk factors including weight and sex. All subjects in the current study were divided into five height-weight classes and they were evaluated before and after the spa therapy course and the follow-up after 10 weeks and six months. To assess the clinical status different questionnaires (HAQ-DI, VAS, Lequesne Index) were used. The results showed that the subjects who participated in the study were mainly females and overweight. In the female group, there were more big type persons, but males were more leptomorphic. Females reported greater knee pain values, but males felt much better after six months. Also, leptomorphs had significantly better changes in the follow-up study. Higher pain diminishing was found in overweight persons but not obese subjects. The subject's functional ability to do usual activities was mild or moderate. Only leptomorphs had significant decrease in the follow-up study. The Lequesne Index related to the function of the knee and score stabilized after 10 weeks in the small and leptomorph group.

Keywords: *height-weight classification, knee osteoarthritis, spa therapy*

INTRODUCTION

Knee osteoarthritis (OA) represents health problems because of pain and functional discomfort and therefore the impact on the quality of life. The objective of OA management is to reduce the pain and improve the mobility of the patient [4].

Spa therapy has a good result in the treatment of OA. Different treatments reduce pain, improve the functions of knee [12] and increase the quality of life [14].

Low back, knee and foot pain associated with the body composition. Obesity is a major risk factor for OA, with the extent of the duration of exposure and gender [7]. Greater weight and the body mass index (BMI) increased the pain level [2]. Obesity is frequently characterized by the BMI, but this index is a measure of both fat and lean mass and does not adequately describe the body composition [11]. In previous studies researchers have found that the increased BMI is associated with different changes in biomechanical patterns of the knee [6]. Females have higher BMI values and therefore they reported greater knee pain [5].

The aim of the study was to divide the subjects who were suffering knee OA into five somatotypes according to the height-weight classification and to find associations with some disease-related values before and after treatment with spa therapies up to six months.

MATERIAL AND METHODS

140 patients with knee OA participated voluntarily in this controlled follow-up study, which included different medical spas of Estonia: Spa Hotel Laine, Tervis Medical Spa and Fra Mare Thalasso Spa. Participants fulfilled the criteria of the American College of Rheumatology`s [1] and were at the age between 47–83. They gave a written consent to participate in the study. The study was approved by the Research Ethics Committee of the University of Tartu. The patients with total knee prosthesis and those who had received thermotherapy in the past three months or had started using analgesics or antidepressants in the past two weeks, were excluded. The patients received spa therapy course, which contains six daily sessions of three different treatments from the list: massage therapy for 25 minutes; herbal bath at 37–39°C for 15 minutes; local mud application at 40–42°C for 15–20 minutes and kinesitherapy for 30 minutes in the gym or in the pool.

To assess the functional and clinical status of subjects, a variety of validated scales has been used: the health assessment questionnaire (HAQ-DI), a visual analogue scale (VAS, 0–10 numeric scale) for pain intensity and the Lequesne Index. HAQ-DI is an assessment of physical function. There are 20 items in eight categories that represent usual activities – rising, eating, walking, dressing, etc. Standard scoring takes into account the use of aids and devices or assistance from another person. For each item, there is a four-level response set, which is

scored from 0 to 3, with higher values indicating more disability [3]. Average knee pain was assessed with a numeric rating scale of visual analogue scale (VAS), where 0 indicating 'no pain' and 10 'insufferable pain' for each knee. The Lequesne Index focuses upon pain, stiffness, maximum walking distance and some activities of daily living. This index assesses the clinical severity of OA using a scoring calculation: mild 1–4 points, moderate 5–7 points, severe 8–10 points, very severe 11–13 points, extremely severe ≥14 points [9].

Subjects were evaluated before and after six days of spa treatments and follow-up after 10 weeks and six months of spa treatments. At the first clinical examination, the anthropometric data (weight – kg, height – cm) and some medical data were collected in an unidentifiable form. No sensitive personal data was recorded. The height and weight values of the subjects were self-reported.

The body mass index (BMI) was calculated using the following standard equation: BMI (kg/m^2) = weight (kg) / height (m^2). The subjects were classified as normal weight (18.50–24.99), overweight (25.00–29.99) and obese (≥30.00) according to the classification system recommended by the World Health Organization [10].

For dividing the subjects by height and weight, the five SD height-weight classification introduced by the Centre for Physical Anthropology at the University of Tartu was used [8]. For all anthropometric variables, the basic statistics (mean values, standard deviations SD, minimum and maximum) were calculated. The five height-weight SD classes (small, medium, large, pycnomorphs, leptomorphs) were created according to the following rules in Übner et al. [13].

Statistical analysis was performed using the SPSS program, version 17.0. The connection between different parameters was analysed with the Pearson's correlation coefficient.

RESULTS AND DISCUSSION

The age of subjects varied from 47 to 83 years (mean 64.8 years). The total number of subjects was 140; 110 females (200 knees) and 30 males (54 knees). 40.0% of the subjects were obese, and 82% of those were females. The means and standard deviations of age, height, weight, and BMI were analysed by gender (Table 1).

Table 1. Basic characteristics of the study sample

Gender		Age	Height (cm)	Weight (kg)	BMI (kg/m²)
Female	Mean	64.3	163.0	78.1	29.4
N=110	SD	6.9	5.8	13.9	4.7
	Minimum	47	150	50	20.0
	Maximum	79	178	115	44.9
Male	Mean	66.6	174.7	88.9	29.1
N=30	SD	8.1	4.8	15.2	4.6
	Minimum	52	164	65	21.5
	Maximum	83	182	130	42.0

N – number of subjects, SD – standard deviation

There was no statistically significant correlation between height and the BMI. Correlations between height and weight was 0.41 (females) and 0.38 (males). Weight and the BMI correlation was 0.92 in females and 0.95 in males. The mean BMI was similar in both genders, but males are 11.7 cm higher and 10.8 kg heavier.

The subjects were classified info five classes of the SD height-weight classification (Table 2). Most subjects in both genders were marked as medium weight (42.1%). Most females were of short height and most male subjects were of medium height. There were more leptomorphs in both genders but only 27.5% of them were males. Therefore the height has an influence and taller persons with normal weight have more problems in knees [13]. In the male group, there were 1.4 times more leptomorphs than among females. In the big class, there were 2.2 times more females than among males. The number of small and medium females was a few percentage points bigger than among males but there were 13% more pycnomorphic males in the male group than among females.

The HAQ-DI index assesses a subject functional ability to do usual activities – dressing, rising, eating, walking, hygiene, reach and grip [3]. Scores of 0 to 1 generally represent mild to moderate difficulty. Pycnomorphs had the highest HAQ-DI values (Figure 1). After 10 weeks comparing to baseline, the highest diminishing had the small subject's group (17.0%) and after six months, the big person's group (24.6%). Differences were not statistically significant (p>0.05), only leptosomic subjects after 6 months had a significant difference (p<0.047) compared to the baseline.

Table 2. Height and weight classification by gender

Gender	Height class		Light	Medium	Heavy	Total
			Weight class			**Total**
Female	Short	Count	20	14	6	40
		% of total	18.2%	12.7%	5.5%	36.4%
	Medium	Count	14	19	6	39
		% of total	12.7%	17.3%	5.5%	35.5%
	Tall	Count	3	12	16	31
		% of total	2.7%	10.9%	14.5%	28.2%
	Total	Count	37	45	28	110
		% of total	33.6%	40.9%	25.5%	100.0%
Male	Short	Count	5	3	1	9
		% of total	16.7%	10.0%	3.3%	30.0%
	Medium	Count	3	4	4	11
		% of total	10.0%	13.3%	13.3%	36.7%
	Tall	Count	1	7	2	10
		% of total	3.3%	23.3%	6.7%	33.3%
	Total	Count	9	14	7	30
		% of total	30.0%	46.7%	23.3%	100.0%

☐ Small, ☐ Medium, ☐ Large, ☐ Pycnomorphs, ☐ Leptomorphs
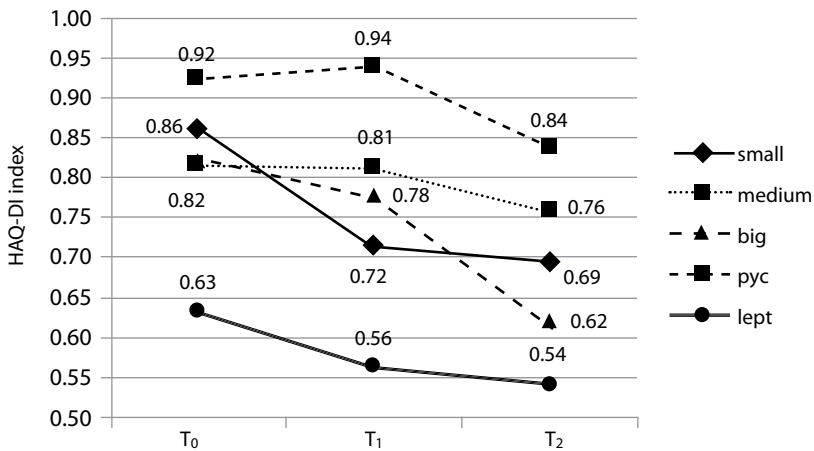

Figure 1. Mean HAQ-DI values according to somatotypes before treatment (T_0), after 10 weeks (T_1), after six months (T_2).

Women reported greater knee pain compared with men (Figure 2). The same was found by Glass et al. [9]. The reasons for the gender differences in knee OA may be related to sex differences in hormones, body composition, knee structure and neural processing [9]. Differences between pain levels were higher in male group. After six months, the mean value was 29.9% lower in the male group than in the female group (17.8%). The greater weight and the BMI associated with the higher pain level [2]. As the female group contained more obese subjects than the male group, the mean pain level remains higher in the female group after six months of taking spa treatments. All differences were statistically significant (p<0.0001) only one difference in the male group was p<0.003.

The greater mean pain in visual-analogue scale was in the medium group before spa treatments. After the 6-day spa therapy course, leptomorphs and small subjects were feeling much better, the pain diminished 38.9% and 38.0% accordingly (Figure 3). All differences after spa and before the spa therapy course in all somatotypes were statistically significant (Table 3). After 10 weeks, the medium group and leptomorphs have lower pain than it was before the spa treatments, 27.7% and 27.3% accordingly. Differences in small and big classes after 10 weeks and before the treatment were not statistically significant (Table 3). Six months after therapy, the big group and leptomorphs had bigger changes in the pain level compared to the baseline, 27.8% and 25.6% accordingly, and were statistically significant (Table 3). Therefore, leptomorphs have better changes in the mean pain level in the follow-up study than other somatotypes.
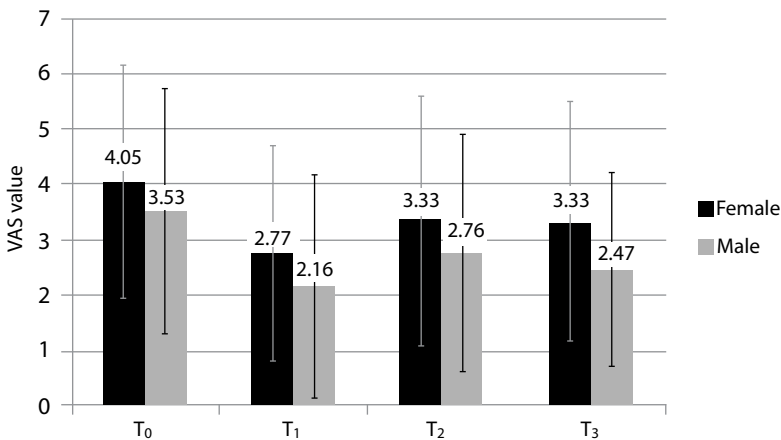

Figure 2. Differences in the mean pain levels in knees between the female and the male group: before therapy (T_0), after therapy (T_1), after 10 weeks (T_2), after six months (T_3).
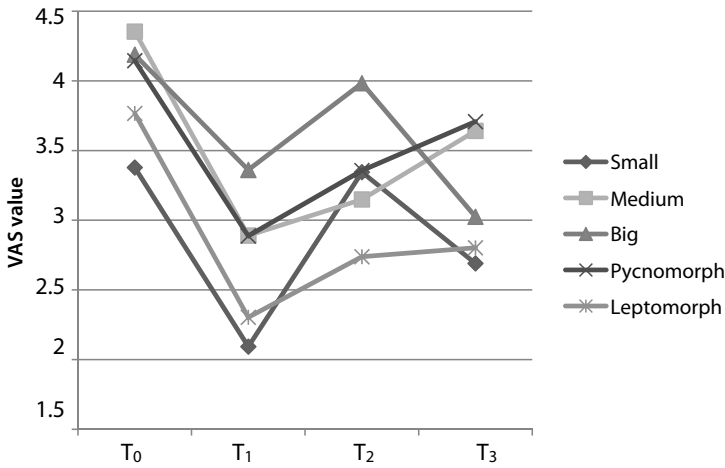
Figure 3. Mean pain values in visual-analogue scale according to somatotypes before therapy (T_0), after therapy (T_1), after 10 weeks (T_2), and after 6 months (T_3).

Table 3. Statistical significances of differences in the mean pain levels (VAS) according to somatotypes: T_{0-1} – before and after therapy; T_{0-2} – before therapy and after 10 weeks; T_{0-3} – before therapy and after six months; N – number of knees

Differences		Small	Medium	Big	Pycnomorphs	Leptomorphs
T_{0-1}	N	46	41	33	62	72
	p	p<0.0001	p<0.0001	p<0.0001	p<0.0001	p<0.0001
T_{0-2}	N	40	37	29	53	66
	p	p<0.551	p<0.001	p<0.645	p<0.001	p<0.0001
T_{0-3}	N	42	34	28	53	65
	p	p<0.013	p<0.001	p<0.022	p<0.036	p<0.0001

Higher BMI values associated with greater pain numbers. The persons with normal weight had a lower mean pain value before spa therapy than the overweight and obese persons, 3.48, 3.84 and 4.22 accordingly. The same was found by Brady et al. [2]. After the spa therapy course the pain level diminished more in the normal weight person group (Table 4). After 10 weeks, obese persons feel much better. After six months, overweight subjects lose 25.9% compared to the baseline mean pain value, but obese persons only 22.3%. According to somatotypes, leptomorphs had higher changes in the pain level. Therefore, the spa therapy course gave a better follow-up result to not very obese persons.

Table 4. Differences (%) of the mean pain level from the baseline after spa therapy course, after 10 weeks and after six months according to BMI: normal weight (18.50–24.99), overweight (25.00–29.99) and obese (≥ 30.00). N – number of subjects

Differences		Normal weight	Overweight	Obese
T_{0-1}	N	41	41	40
	%	46.6	12.4	14.8
	p	$p<0.0001$	$p<0.125$	$p<0.048$
T_{0-2}	N	109	95	94
	%	31.5	20.7	25.9
	p	$p<0.0001$	$p<0.0001$	$p<0.0001$
T_{0-3}	N	104	89	88
	%	29.9	24.1	22.3
	p	$p<0.0001$	$p<0.0001$	$p<0.0001$

The decrease in the Lequesne Index indicated the improved movement and the function of knee [4]. In the current study, higher values were mainly in big subjects (Figure 4). The clinical severity of OA of big and pycnomorphic persons was before the spa therapy in the severe level (Table 5). After six months, the Lequesne Index score diminished 13.1% and 17.8%, accordingly, but still remained in the severe level. The biggest statistically significant changes during six months according to the baseline were in the small subject group. The Lequesne Index value diminished 28.4 % from the baseline. The statistically significant improvement was also in the leptomorph group during six months. The Lequesne Index score stabilized in those two groups after 10 weeks of spa therapy.
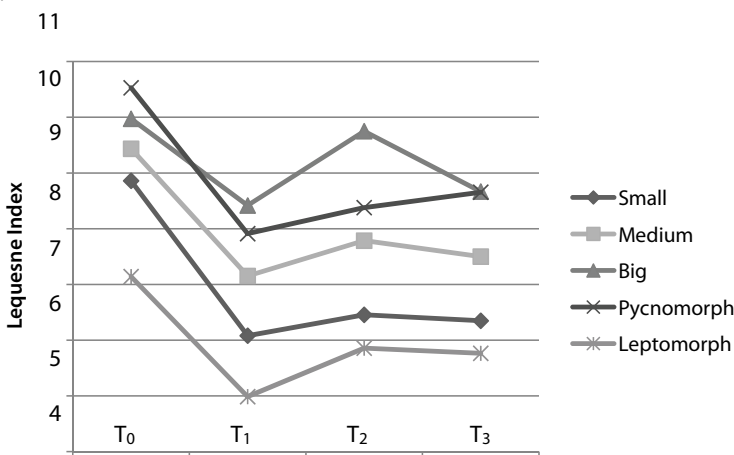

Figure 4. The Lequesne Index mean values according to somatotypes before therapy (T_0), after therapy (T_1), after 10 weeks (T_2), and after six months (T_3).

Table 5. The clinical severity of knee OA according to somatotypes

The clinical severity		Small	Medium	Big	Pycnomorphs	Leptomorphs
T_0	N	25	23	18	34	39
	Severity	severe	severe	severe	severe	moderate
T_1	N	25	23	18	34	39
	Severity	moderate	moderate	severe	moderate	mild
	p_{T0-T1}	p<0.0001	p<.0001	p<0.003	p<0.0001	p<0.0001
T_2	N	22	21	16	29	37
	Severity	moderate	moderate	severe	severe	moderate
	p_{T0-T2}	p<0.001	p<0.077	p<0.686	p<0.003	p<0,006
T_3	N	23	19	15	29	36
	Severity	moderate	moderate	severe	severe	moderate
	p_{T0-T3}	p<0.001	p<0.059	p<0.121	p<0.049	p<0.011

N – number of subjects

CONCLUSIONS

The subjects in the current knee OA study were mainly females and overweight. Higher weight related to the higher BMI values. Dividing the subjects into five height-weight classes, it was found that in the male group, there were more leptomorphs and in the female group, there were more big persons.

The HAQ-DI index gave higher values to pycnomorphs, however, only leptomorphs had significant decrease after six months compared to the baseline.

Females reported greater knee pain values than males, but males felt significantly much better after six months of taking spa therapy. The pain level diminished in all somatotypes, but leptomorphs had significantly better changes in the mean pain levels compared to the baseline. Higher pain levels also associated to higher weight but better results in the follow-up study had overweight not obese persons.

The Lequesne Index score improved in all somatotype classes, but the biggest significant improvement was in the small subject group.

The spa therapy follow-up study showed that according to the somatotypes, there are more leptomorphs in the knee OA subjects and better significant improvements in the pain scores and functional ability of the knee had also leptomorphs.

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