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Full Length Research Paper

Effects of occupation and physical features on musculoskeletal pain: Correspondence analysis

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The objective of this work is to evaluate the effect of occupation and physical features on musculoskeletal pain location. One thousand, nine hundred and eighty seven (1987) voluntary adults participated in the study from 7 regions of Turkey in 2006. Subjects with musculoskeletal pain of at least one month's duration that had been recurrent minimally twice in any regions of the body and who had not taken any medication and treatment were included in this study. Data were gathered through an anonymous self-reporting questionnaire which included questions such as pain location on the schema, age, gender, case and family history, occupation, height, weight and Body Mass Index (BMI) and residence region of Turkey. Corresponding analysis results are statistically significant between variables in all groups ($p<0.05$). While neck pain is more frequent among civil servants and students, lower extremities pain is frequent in housewives. Hip and chest pains are more seen in the retired subjects. There are relatively more head, elbow, abdomen and thoracic pains in 18 to 25 age group whereas neck, low-back, leg and ankle pains are observed in 26 to 40 age group. Shoulder/arm and low back pains are relatively more frequent among 41 to 55 ages. All extremity pain is more frequent in females between 41 and 55 ages. Knee and low back pains are relatively more frequent in subjects heavier than 76 kg and BMI of 25 kg/m^2 or greater. Sedentary life, work related problems and obesity are apparent in early ages and musculoskeletal pain locations are especially in vertebral column. All ages of the community should be well-informed about how to prevent the musculoskeletal problems.

Key words: Pain, public health, musculoskeletal diseases, questionnaires, corresponding analysis.

INTRODUCTION

Musculoskeletal complaints are frequent and have large consequences for public health (Briggs et al., 2009). The assessment of musculoskeletal pain is necessary in the clinical setting for diagnosis and choice of treatment (van der Waal et al., 2003). Musculoskeletal pain can arise from some intra-individual and extra-individual (environmental) factors (Jorgensen et al., 2000). More severe pain and previous neck pain were associated with a worse prognosis of neck pain in the study of Borghouts et al. (1998). Ariëns et al. (2000) reported a positive association between neck pain and the following work-related physical risk factors: neck flexion, arm force, arm posture, duration of sitting, twisting or bending of the trunk, hand-arm vibration and workplace design. Van der Windt et al. (1996) observed that high risks of persistent or recurrent shoulder complaints were found in patients with concomitant neck pain and severe pain during the day. Hayes et al. (2009) found that the musculoskeletal

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disorders were most commonly reported by students at the neck (64.29%), lower back (57.94%) and shoulder (48.41%) regions. In the studies of Jorgensen et al. (2000) and Giske et al. (2009) psychological distress acted as a determinant of physical health change, sick leave and patient self-rated improvement in patients with musculoskeletal illness. Psychosocial variables, such as depressive symptoms or inadequate pain behavior, have not often been taken into account although these factors have been shown to be related to a high risk of chronicity in low back pain (Burton et al., 1995). So far, the majority of research has evaluated the prognostic value of clinical characteristics (symptoms and signs), whereas little attention has been given to the potential prognostic value of physical and occupational factors.

Correspondence analysis (CA) about musculoskeletal diseases has not been studied extensively. Coste et al. (1991) studied the clinical and psychological features of non-specific low-back pain (LBP) (n = 330) by using multivariate statistical methods including CA. Montreuil et al. (1996) studied the relationship between some socio-professional characteristics of workers (for example age, actual work done, experience in the job, overall time on job market, height) carrying out thread-cone handling tasks and their musculoskeletal pain profiles by using the Factorial Analysis of Correspondence and the Hierarchical Ascendant Classification. Johansson et al. (2003) investigated the prevalence of symptoms related to temporomandibular disorders in 50-year-old subjects (n: 8.888) living in the counties of Orebro and Ostergotland, Sweden. Harcombe et al. (2009) described the prevalence, characteristics and impact of musculoskeletal disorders in New Zealand nurses, postal workers and office workers. Despite of the literature studies, no more studies have investigated the effect of physical features, occupation and geographic places on pain location of the musculoskeletal pain. It appears studies about musculoskeletal pain are not thoroughly investigated in Turkey. Salik and Ozcan (2004) studied work related musculoskeletal disorders in physiotherapists living in Izmir. Another study is our study previously published about trigger points in young university subjects (Cimbiz et al., 2006). The purpose of this study was to evaluate the effect of occupation and physical features on musculoskeletal pain location by using CA test.

MATERIALS AND METHODS

One thousand nine hundred eighty seven (N=1987) voluntary adults of both sexes participated into the study from 7 regions (randomized samples from Marmara, Aegean, Mediterranean, Inner Anatolia, Black Sea and South East Anatolia) of Turkey in 2006. Subjects with musculoskeletal pain of at least one month duration and with recurrent complaints twice in any parts of the body were included in this study. Exclusion criteria for participants were neurological diseases, intestinal or cardiopulmonary pain, having taken medication or having been included in any therapy program during the assessment and malignancy. Data were gathered by means of an anonymous self-reporting questionnaire for which participants were selected by random sample techniques. The survey instrument was a simple two page anonymous form including questions such as pain location on the schema, age, gender, case and family history, occupation, height, weight and BMI and residence region of Turkey. The study had location research and ethics committee approval, and participants gave oral consent.

Statistical analysis

SPSS 13.0 version for Windows was used for all statistical analysis. In the study, CA is used to describe the relationships between pain location variables and various physical features variables. CA is a method describing synthetically a contingency table in which homogenous individuals are classified on two categorical variables (Uzgören, 2007).

Analysis

The columns and the rows are usually used to describe the categories of the variables (Greenacre and Blasius, 1994). The aim of the study is to assign a base category for the relationship between pain location variable and various physical features variables (occupation, age, gender, height, weight and geographic area). The described variable is pain location and so the categories belonging to pain location variable are represented in columns. These categories are defined as head, neck, elbow, abdomen, hip, knee, all extremities, shoulder, upper extremity, thoracic, low-back, chest, forearm, lower extremities and polyarticular.

RESULTS

Demographic and physical features of the subjects were shown in Table 1.

Interpretation of maps

A CA was interpreted by examining the positions of the row categories and column categories as reflected by their respective coordinate values. The values of the coordinates reflect associations between categories of the row variable and column variable. If it is assumed that a two-dimensional solution provides an adequate fit, then row points that are close together indicate row categories that have similar profiles (relative frequencies) across the columns. Column points that are close together indicate columns with similar profiles down the rows (Everitt and Dunn, 2001). If all the categories have equal profiles, all the points will fall in the centroid (Clausen, 1998).

CA results of relationship between pain location and occupation

The aim in this part was to assign a base category for the relationship between pain location variable and occupation variable. The CA map is given in Figure 1. A

Table 1. Demographic and physical features (N: 1987).

Parameter	Values
Age (year)	38.4 ± 15.7 (12 – 88)
Weight (kg)	70.2 ± 12.7 (28 – 115)
Height (m)	1.68 ± 0.9 (1.40 – 2.00)
BMI	25.0 ± 4.5 (15 – 44)
Sex, F/M (n, %)	1079 (54.3) / 908 (45.7)
Occupation (n, %)	
Housewife	603 (30.4)
Student	507 (25.5)
Civil servant	326 (16.4)
Irregular	196 (9.9)
Retired	144 (7.2)
Worker	136 (6.8)
Farmer	50 (2.5)
Unemployed	25 (1.3)

Data are shown as mean ± S.D, n (%).

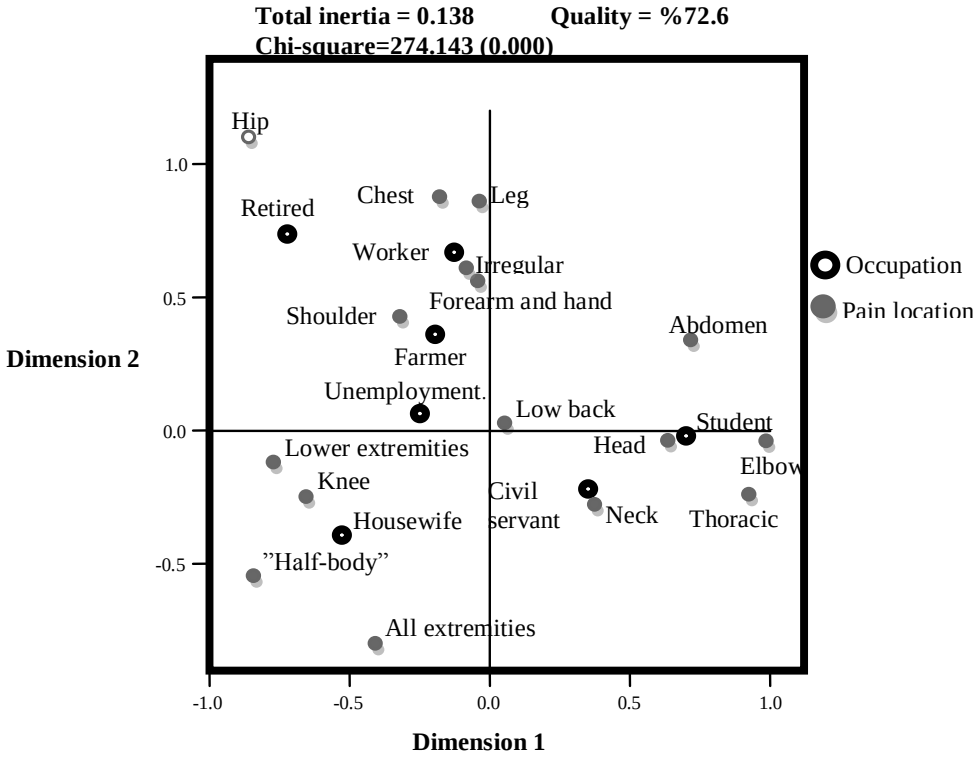

Figure 1. CA map of occupation and pain location.

significant relationship between pain location and occupation was observed (χ^2 = 274.143, P: 0.000). Abdomen, head, thoracic and elbow pains are relatively more frequent among the students. Neck pain was relatively more frequent among the civil servants. There are relatively more knee, lower extremity, "half-body" and all extremities pains in the housewives. Hip and chest pains are relatively more seen in the retired subjects. Upper extremity and leg pains are relatively more frequent among the workers. Worker and irregular subjects generally have same pains and so they have

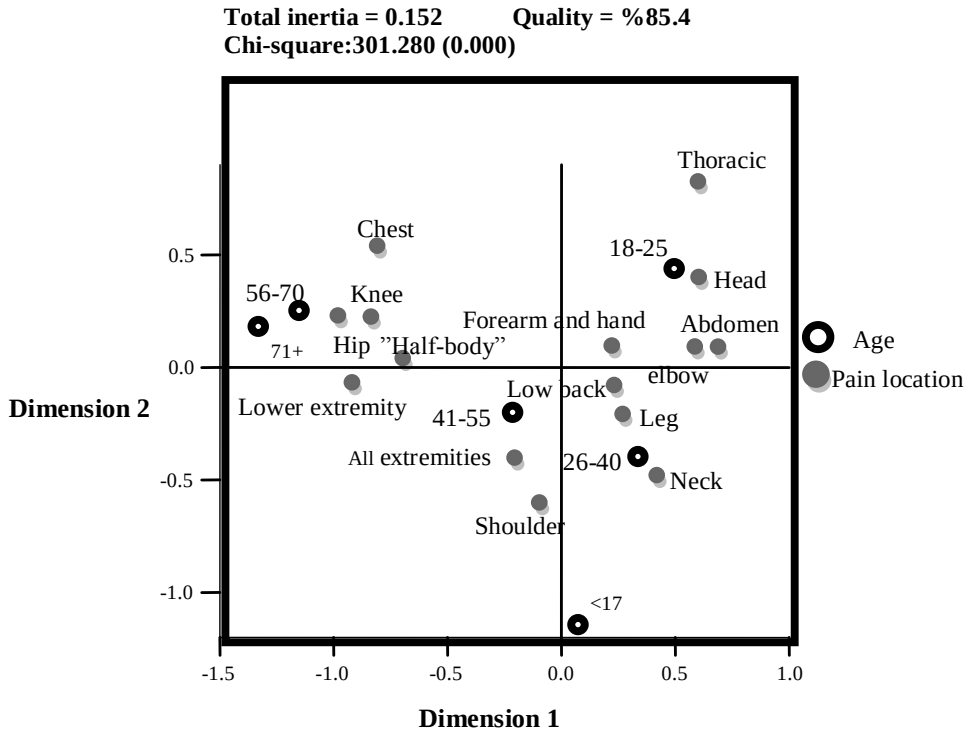

Figure 2. CA map of age and pain location.

relatively more frequent shoulder, forearm and leg pains.

Since unemployed and low-back categories are close to origin, it can be said that these categories do not have a high degree relationship with other categories. There is a negative association between housewife and abdomen categories.

CA of relationship between age and pain location

The aim in this part was to assign a base category for the relationship between pain location variable and age variable. The CA map is given in Figure 2. There was not a prominent pain in persons younger than 17 ages. A significant relationship was found between pain location and age ($\chi^2 = 301.280$, P: 0.000). There are relatively more head, elbow, abdomen and thoracic pains in 18 - 25 age group while neck, low-back and leg pains dominate in 26 - 40 age group. Shoulder and low-back pains are relatively more frequent among 41 to 55 ages.

The subjects who are 56 to 70 and 71+ ages have same pains and in these subjects hip, knee, lower extremity and "half-body" pains are seen relatively more.

CA of relationship between gender, age and pain location

The CA map is shown in Figure 3. A significant relationship has been found between gender age and pain location and age ($\chi^2 = 460.112$, P: 0.000). In males older than 71 age the chest pain was seen relatively more. Shoulder pain is seen relatively more in females younger than 17 age and in males between 56 to 70 ages. In females older than 56 age knee, all extremities, lower extremity and "half-body" pains are seen relatively more. Females between 18 and 25 ages are placed close to head, abdomen and thoracic pains, whereas the corresponding group of males is grouped together with low-back, elbow and forearm pains. All extremities pain is relatively more frequent in females between 41 and 55 ages.

CA of relationship between height and pain location

The aim in this part was to assign a base category for the relationship between pain location variable and height variable. Figure 4 shows the CA maps of height and pain location. Similarly, a significant relationship was observed between height and pain location and age ($\chi^2 = 84{,}704$ P: 0.008). Total inertia is rather close to zero and then the most points belong to rows and columns are close to origin of axes, so there is not a powerful association between height and pain location variables.

Accordingly, chest, shoulder, leg, neck and forearm

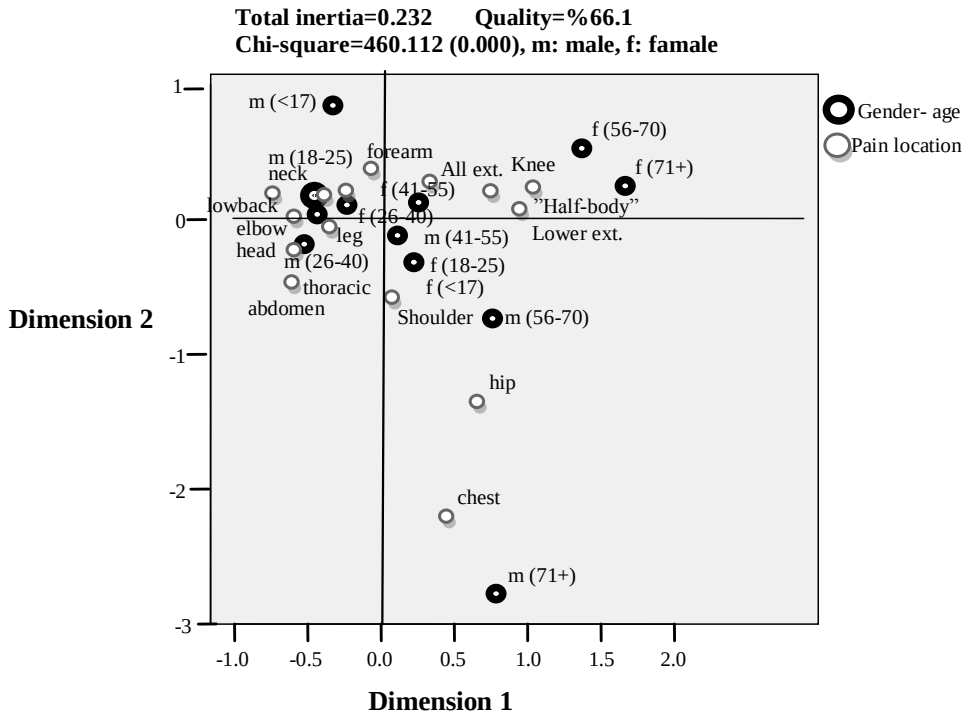

Figure 3. The two dimensional symmetric CA map of gender, age and pain location.

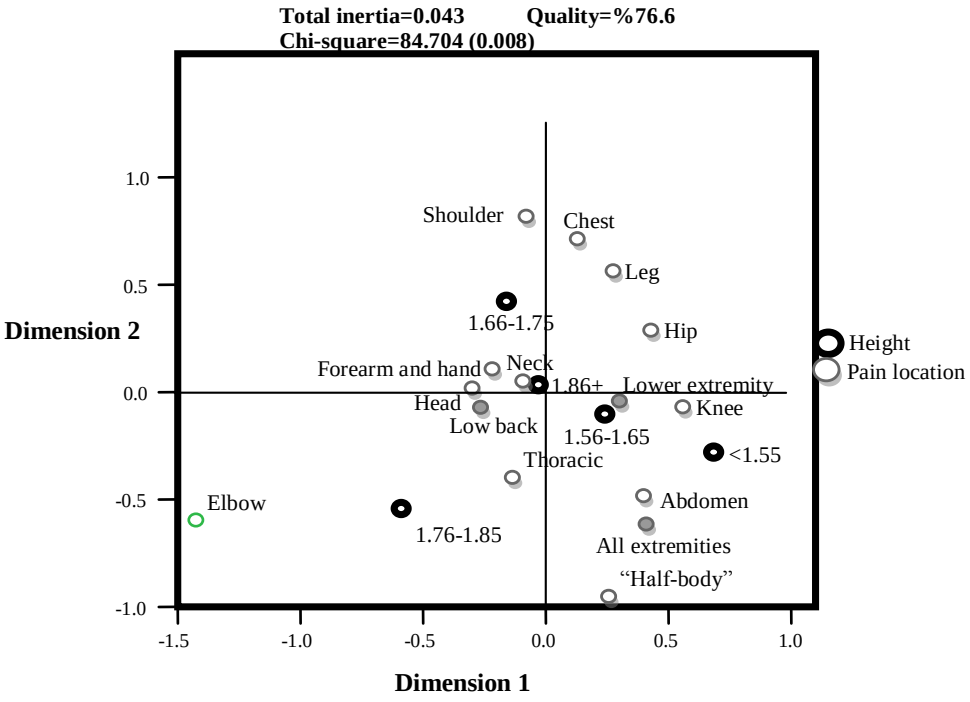

Figure 4. CA map of height and pain location.

pains are relatively more prevalent in persons between 1.66 and 1.75. Elbow pain is relatively more frequent between 1.76 and 1.85 heights. There is relatively more knee pain in persons 1.55 and shorter than 1.55 heights.

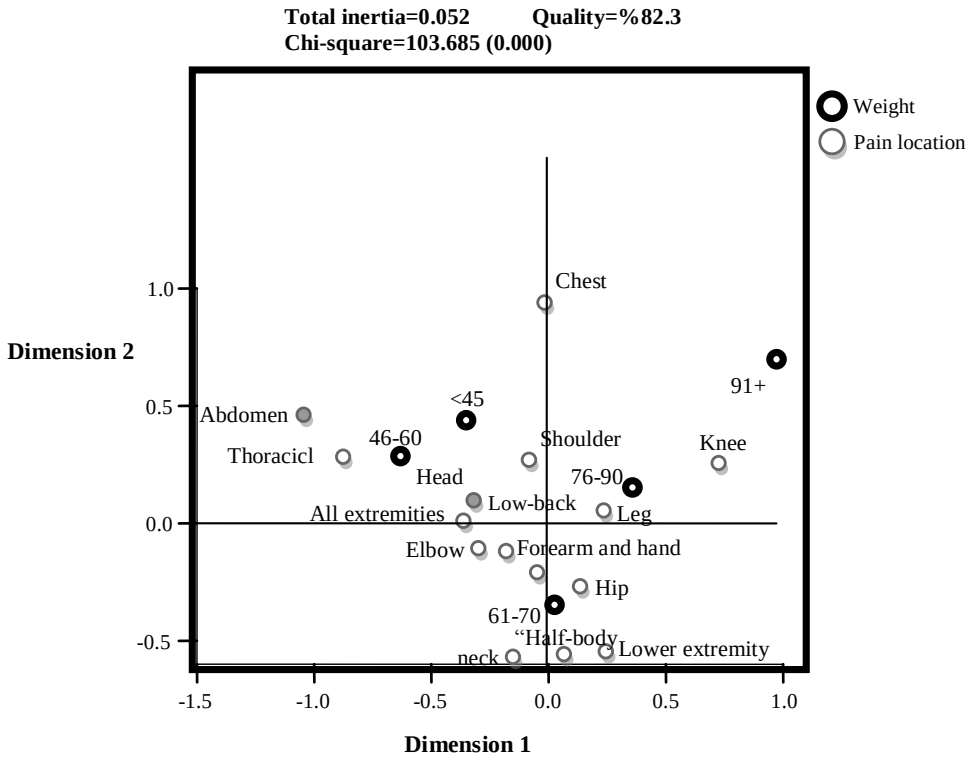

Figure 5. CA maps of weight and pain location.

CA of relationship between weight and pain location

The aim in this part was to assign a base category for the relationship between pain location variable and weight variable. Figure 5 shows the CA maps of weight and pain location. A significant relationship has been found between height and pain location and age ($\chi^2 = 103.685$, P: 0.000). Knee and low back pains are relatively more frequent in adults heavier than 76 kg. There are relatively more neck, "half-body" and lower extremity pains in the subjects between 61 and 70 kg. Head, abdomen and thoracic pains are relatively more frequent in the subjects between 46 and 60 kg.

CA of relationship between geographic area in Turkey and pain location

The aim in this part was to assign a base category for the relationship between geographic area and pain location variables. Figure 6 shows the CA maps of these variables. A significant relationship was also found between height and pain location and age ($\chi^2 = 168.575$ P: 0.008). There are relatively more hip, knee, shoulder, lower extremity, thoracic and forearm pains in Aegean area. All extremity and low back pains are relatively more frequent in persons living in east Anatolia and Mediterranean areas. Subjects living in Inner Anatolia, Marmara and South-East Anatolia areas have same pains and head and chest pains are seen relatively more. There is relatively more prevalent leg pain in Black Sea area.

DISCUSSION

Recently, several studies have been performed in which risks associated with physical characteristics (Han et al., 1997) and employment (Hartvigsen et al., 2000; Miranda et al., 2011; Shelerud, 1998) were investigated in low back pain patients. The demographic factor most commonly found to be associated with chronic disability is older age (Crook and Moldofsky, 1996; Hartvigsen et al., 2000; Shelerud, 1998). With respect to work-related factors, most studies have found occupation not to be associated significantly with chronic disability (Crook and Moldofsky, 1996).

In a study, student physiotherapists are potentially exposed to the same LBP occupational risks as graduates, such as poor working postures and frequent manual handling activities, often undertaken in difficult environments and with variable training regarding personal safety (Nyland and Grimmer, 2003). For approximately 25% of the time during the class lessons, students are sitting with the trunk flexed by more 20°. Forward head posture, rounded shoulders and kyphosis are very commonly observed postural deviations (Muphy

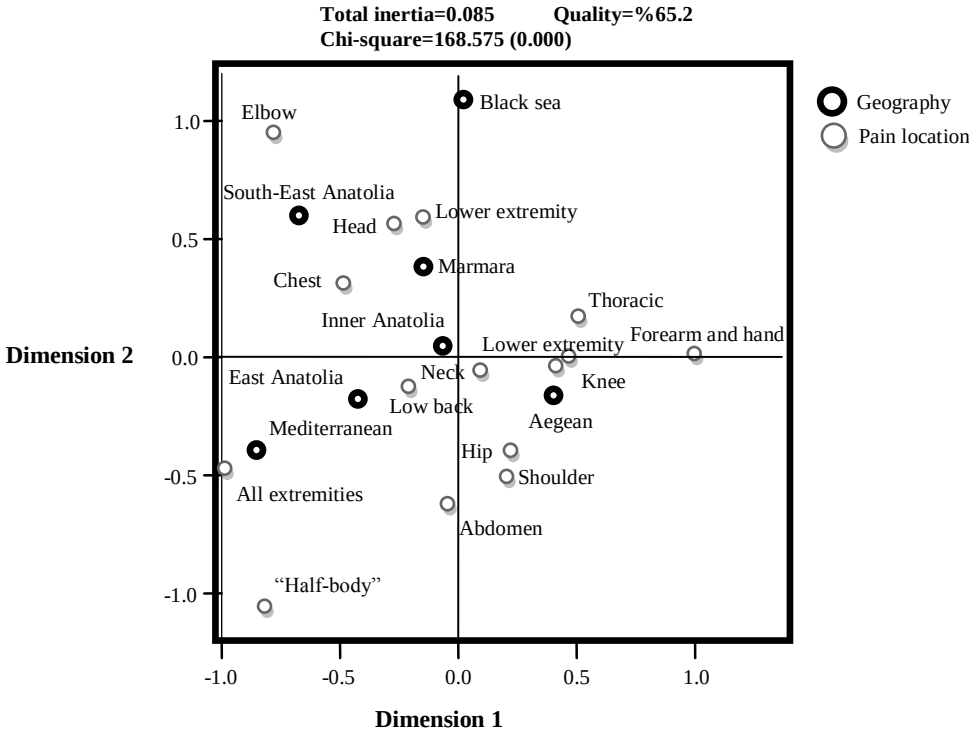

Figure 6. CA map of Geographic area and pain location.

et al., 2004). In addition, trigger points are also observed in cervical and thoracic region (Cimbiz et al., 2006). In our study, in civil servants and students pain is observed on neck region. Our results are concordant to the literature studied.

Farm workers perform strenuous task and are exposed to a wide variety of occupational risks and hazards. Low socioeconomic status and poor access to health care also contribute to existing health problems in this population. Potential farm work-related health problems include accidents, pesticide-related illnesses, musculoskeletal and soft-tissue disorders, dermatitis, non-infectious respiratory conditions, reproductive health problems, health problems of children of farm workers, climate-caused illnesses, communicable diseases, bladder and kidney disorders, and eye and ear problems (Mobed et al., 1992). Osborne et al. (2010) studied in 600 farmers and found of 56% had experienced a musculoskeletal pain in the previous year. They reported that the most commonly experienced musculoskeletal pain were back pain (37%) and neck/shoulder pain (25%). Our results are compatible with these studies. In worker subjects, we found that the pain is irregular and generalized. Shoulder, arm, wrist and hand in upper extremity, hip, knee, leg and the ankle in lower extremity are frequently affected.

Experimental studies demonstrate significant gender differences concerning pain perception and responses. In a previous study, women reported lower pain threshold, pain tolerance, and analgesic response after experimental exposure to pain when compared with men (Keogh and Herdenfeldt, 2002). In this current study, in ages 56 and over; and ages 18 to 25, lower extremity pain and thoracic pain respectively were observed higher in females than in men. Osteoarthritis and osteoporosis especially affected the females in ages over 50. Thoracic and neck pain were observed in young ages more in female than in male; while low-back and lower extremities pain starts from age 40. However, chest pain was observed more significantly in seventies and among male subjects.

Several studies demonstrated positive association between obesity and low-back pain related conditions (O'Neil et al., 1999; Symmons et al., 1991). O'Neil et al. (1999) noted that increasing BMI is associated with more frequent findings of osteophytes (bone spurs) at both the thoracic and lumbar spines. The correlation of osteophytes and increased BMI is highest at the thoracic level (O'Neil et al., 1999). Biering-Strenson et al. (1985) noted that absolute weight and BMI are significantly higher in persons 60 years of age with spondylosis. Both men and women with BMI of 30 kg/m^2 or higher were twice as likely to have difficulties in performing a range of basic daily physical activities as those with BMI lower than 30 kg/m^2 (Biering-Strenson et al., 1985). Compared with women with BMI lower than 25 kg/m^2, those with BMI of 30 kg/m^2 or higher were 1.5 times more likely to have symptoms of intervertebral disk herniation (Lean et al., 1999). Conversely, Luoma et al. (1998) concluded that disc degeneration is not related to body height,

overweight, smoking, or the frequency of physical activity. In addition, studies by Riihimaki et al. (1989), Symmons (1991), and Kang et al. (1995) have shown no association between BMI and low back related problems. In our study, subjects heavier than 76 kg and with BMI 25 and over were found to be under risk of the low back pain and lower extremities pain. Conversely, to previous studies, we observed that low-back problems appear in lower ages and lower weights. We opined that this situation might have arisen from increasing sedentary life style of younger ones. Another hypothesis in the literature is that a person who suffers from continuing bouts of low-back pain may be predisposed, due to inactivity or inability to exercise, to gain weight thus increasing their BMI (Mirtz and Greene, 2005; Verbunt et al., 2003).

Lower healthcare insurance and economic recession in Turkey appears to be decreasing the importance of focusing on effects of musculoskeletal pain. Therefore, clinicians and physiotherapists encounter patients with chronic musculoskeletal disorders. These results decrease the success of the treatment. Another important finding in this study is on geographic area. There are relatively lower extremities and vertebral column pain in Aegean, Mediterranean and East Anatolia area. These areas have Mediterranean climate except east Anatolia. Subjects living in inner Anatolia, Marmara and South-East Anatolia areas have relatively more head and chest pains. There is relatively more prevalent lower extremity pain in Black Sea area. These distinctions might result from sunny climate and humidity; however, we can not explain the effects of the climate and geographic with only these factors. In our opinion, physical characteristics and occupation are more related on musculoskeletal pain location than geographic area. However, in all geographic areas we find musculoskeletal complaint as prevalent in young subjects as in the older. The relative large sample size in this study tends to give more credibility to the current findings compared to the low sample size in previous studies. However, some subjects marked the head, chest and abdominal pain as musculoskeletal pain. This might be a limitation to this study. Further studies should be conducted about relationship between musculoskeletal pain location and education status.

Conclusion

Sedentary life, work related problems and obesity is apparent in the early ages and the musculoskeletal pain location is especially observed on vertebral column and lower extremity. Lower extremity problems are shown especially in women and fourth age decade. All ages of the community should be well-informed about how to prevent the musculoskeletal problems.

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