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Original Article

Pain, Work-related Characteristics, and Psychosocial Factors among Computer Workers at a University Center

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Abstract. [Purpose] Complaint of pain is common in computer workers, encouraging the investigation of pain-related workplace factors. This study investigated the relationship among work-related characteristics, psychosocial factors, and pain among computer workers from a university center. [Subjects and Methods] Fifteen subjects (median age, 32.0 years; interquartile range, 26.8–34.5 years) were subjected to measurement of bioelectrical impedance; photogrammetry; workplace measurements; and pain complaint, quality of life, and motivation questionnaires. [Results] The low back was the most prevalent region of complaint (76.9%). The number of body regions for which subjects complained of pain was greater in the no rest breaks group, which also presented higher prevalences of neck (62.5%) and low back (100%) pain. There were also observed associations between neck complaint and quality of life; neck complaint and head protrusion; wrist complaint and shoulder angle; and use of a chair back and thoracic pain. [Conclusion] Complaint of pain was associated with no short rest breaks, no use of a chair back, poor quality of life, high head protrusion, and shoulder angle while using the mouse of a computer.

Key words: Ergonomics, Low back pain, Workplace

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INTRODUCTION

Use of computers at workstations has been widely adopted in companies and institutions. It is well known that adoption of inadequate postures at work, repetition of computer tasks such as typing and use of a computer mouse, and sitting for long periods of time lead to symptoms in the neck, upper limbs, eyes, thoracic spine and low back[1, 2)]. In a study carried out in Brazil with bank workers, 56.2% of the sample showed upper extremity and neck symptoms[3)].

The postures adopted at work can also lead to pain[4–6)] and postural imbalance[7)]. The head position (bending of the neck), shoulder abduction angle, and use of a computer mouse are important factors related to musculoskeletal disorders[5, 6)], mainly if a person uses a computer device for a great number of hours per day.

Another important issue that has been discussed in recent years is psychosocial health at work[6, 8, 9)]. Job satisfaction, motivation, and quality of life (QOL) are key subjects to achieve high performance in work activities. A study carried out in Portugal[8)] found that 26.4% and 25.8% of university workers were dissatisfied and unmotivated, respectively, both of which are associated with absenteeism and can lead to trouble in the work environment. Hagberg et al. stated that when musculoskeletal discomfort affects QOL, it needs to be identified as soon as possible so the appropriate treatment can be applied[9)].

Considering that prolonged sitting in fixed positions increases biomechanical stress on the back, neck, and upper limbs[10)] and that psychosocial factors are associated with pain[6)], evaluation of specific postures adopted during work activities as well as workers' QOL and motivation is important in order to better understand the origin of some symptoms. There are already some studies discussing this issue[1–3, 5, 6, 10, 11)], but few of them are from Brazil[3, 11)]. Furthermore, none of the previous studies included both biomechanical and psychosocial factors in their analyses. Therefore, the aim of the present study was to verify the relationship among work-related characteristics, psychosocial factors, health-related quality of life, and pain among workers from the a university center in Rio de Janeiro, Brazil.

SUBJECTS AND METHODS

This cross-sectional study evaluated 15 office workers who use a computer at work from a university center in Rio de Janeiro, Brazil. The inclusion criteria were as follows: adults aged 18–60 years old, right handed, at least six months working in the institution in their current position, and use of computers to do their job tasks for at least four hours per day. Informed written consent was obtained from

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all participants. Those presenting any implantable electronic or metallic device, such as a pacemaker, and pregnant women were excluded from body composition analysis.

Measurements were mainly performed at the Laboratory of Human Movement Analysis (Postgraduate Program of Rehabilitation Sciences-UNISUAM) and at the participants' workplace. Laboratory evaluations included: a) anthropometric and bioelectrical impedance measurements to verify body composition and b) photogrammetry to assess postural alignment. Workplace evaluations comprised measurements of desks, chairs, computer screens, mice and keyboards, and body segment lengths. Distances, heights, lengths, and angles were measured while volunteers were operating these devices. The two set of evaluations (laboratory and workplace) were carried out on different days. On the first day of evaluation, subjects received some questionnaires (described below) to answer at home, and these were to be returned on the second day of evaluation. When the laboratory evaluations were scheduled, the following recommendations were informed to each participant: 1) do not consume alcohol or exercise within 24 hours prior to the test; 2) do not consume caffeine or food for 4 hours prior to the test; 3) drink 2 to 4 glasses of water within 2 hours prior to the test; 4) use the bathroom use within 30 minutes prior to assessment, and 5) wear minimal clothing without any metallic parts for photogrammetry and body composition analysis.

The protocol was approved by the institutional ethics committee (CAAE:0009.0.307.000-11), and written informed consent was obtained from all participants before participation in this study.

The weights and heights of the subjects were measured using an analog balance scale (rounded to the nearest 0.1 kg) with a stadiometer applied (rounded to the nearest 0.005 m) (R110, Welmy®, São Paulo, Brazil). Body mass index (BMI) was calculated following the standard method (BMI = weight/height^2)[12]. Waist circumference was measured at the narrowest point between the lower costal border and the iliac crest[13] with a flexible steel tape (Terrazul®, São Paulo, Brazil; 0.1 cm).

Body composition analysis was performed using a bioelectrical impedance analyzer (BIA 310e, Biodynamics®, Shoreline, WA, USA). The test current used was 800 µA at 50 kHz, well below the Association for the Advancement of Medical Instrumentation's standard for "Safe Current Limi". The tetrapolar resistance and reactance measurements were collected in a standardized manner: the subjects were asked to rest for five minutes prior to the exam on an examination table. They stood barefoot, without any metal objects close to them. Feet and hands were at least 30 and 15 cm apart, respectively. Two electrodes were applied to the dorsal surface of the right hand, and two were placed on the dorsal surface of the right foot. Resistance and reactance provided by the analyzer were used for fat free mass (kg) estimation. Other analyzed variables were fat mass (kg) and fat percentage (%). The equation selected to predict fat free mass was previously validated in a study of 20–94-year-old adults[14] and was as follows $FFM = -4.104 + 0.518\ (H^2/R) + 0.231\ (BW) + 0.130\ (Xc) + 4.229\ (G)$, where FFM = fat free mass (kg), H = height (cm), R = resistance (Ω), BW = body weight (kg), Xc = reactance (Ω), and G = gender (0 for females and 1 for males).

Anterior (AV) and right view (RV) pictures were taken with a camera (DSC-H7, 8.1 megapixels, Sony, Japan) placed on a tripod at one meter above the ground and three meters from the participant. A black background and a plumb line marked with two Styrofoam balls (placed at a distance of 100 cm) were used to ensure better definition and to calibrate the images while analyzing them in the Postural Assessment Software (PAS/SAPO version 0.68, 2007, São Paulo, Brazil)[15]. The following anatomical landmarks were marked with Styrofoam balls (15 mm diameter): C7 spinous process, right and left tragus, acromions, anterior superior iliac spines (ASIS), posterior superior iliac spines (PSIS), greater trochanters, and malleoli. The analyzed angles in the AV were the head horizontal alignment (angle formed by a tragus line and horizontal line) and acromion-ASIS angle (angle formed by an acromion line and ASIS line). For both angles, a positive value indicates inclination to the right, and a negative value indicates indication to the left. In the RV, the following angles were analyzed: head protrusion (angle formed by a C7-tragus line and horizontal line), pelvic tilt (angle formed by an ASIS-PSIS line and horizontal line), and hip angle (angle formed by an acromion-greater trochanter line and greater trochanter-malleolus line). Analyses were done offline, and the PAS/SAPO software can be considered a useful and reliable tool for measuring body posture[15, 16].

The following variables were assessed with a measuring tape (Western Pro 5 m × 19 mm, Western, Brazil): desk and chair heights, lengths, and widths; computer screen height (from the floor to the top of the screen); thigh length (from the knee joint line until the buttocks); leg height when sitting (from the knee joint line until the floor); and eye height when sitting (from the eye lateral mark until the floor). To measure the length of the back without support, a flexible steel tape (Terrazul®, São Paulo, Brazil) was used. A goniometer (Carci®, São Paulo, Brazil) with values rounded to nearest 2° was used to measure the shoulder abduction angle in the frontal plane while the subjects used a computer mouse (fulcrum at the acromion, one arm in the direction of the floor and the other arm in the direction of the olecranon), the elbow angle in the sagittal plane while the subjects were typing (fulcrum at the lateral epicondyle of the elbow, one arm in the direction of the styloid process of the radius and the other arm in the direction of the humerus), and the knee angle while the subjects were sitting in the sagittal plane (fulcrum at the knee joint line, one arm in the direction of the greater trochanter and the other arm in the direction of the malleolus). All variables were measured on the right side. Whether or not the subjects were using their chair backs was also noted during the visit.

Complaints of pain were assessed using the validated Portuguese version of the Nordic Musculoskeletal Questionnaire[17] and the Multidimensional Pain Evaluation Scale[18]. The participants were asked to indicate the regions in which they experienced pain within the last year. Body regions were analyzed separately and were also grouped as proposed by Hakala et al.[1]: a) neck or shoulders; b) hands, fingers, and wrists; c) lower back; d) head; and e) eyes. When a complaint was reported, the intensity was evaluated using the visual analog scale (varying from 0, no pain, to 10, the most intense pain).

The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) was used to assess the health-related quality of life (QOL) of the sample using its translated and validated Portuguese version[19]. The SF-36 is a generic QOL assessment instrument composed of 36 items, divided into eight dimensions: physical function (PF), general health (GH), vitality (VT), mental health (MH), social function (SF), role-emotional (RE), role-physical (RP), and bodily pain (BP). Answers are presented on a Likert scale. Each scale ranges from 0 to 100 points, with 100 points representing the best satisfaction with QOL, while 0 points represents the highest dissatisfaction with QOL[20, 21].

To evaluate subjects' motivation at work, a questionnaire proposed and validated by Ferreira et al.[22] was used. The scores were calculated for four subscales: job organization, performance, execution/power, and involvement, and ranged from 0 to 100%. Higher scores represent great motivation at work.

The participants also answered some questions about their work-related behaviors, like the number of short breaks (of at least five minutes) that they take during the work day; the number of hours spent in a seated position; the number of working hours in a workday; and the length of time, in years, that the subject had worked at the institution. There were also some questions about lifestyle issues, like sleep position, hours of sleep, and exercise practices.

The sample was analyzed as a whole or stratified for presence of short breaks (No Rest Break Group, NRBG, and Short Rest Breaks Group, SRBG), and complaints of pain complaint at each body region (Complaint Group and No Complaint Group). This stratification was performed in order to identify a possible association between the use of rest breaks throughout the workday and all the work-related characteristics assessed in this research. The participants were also analyzed separately for the use of a chair back.

Due to the small sample size, nonparametric tests were chosen. For numeric variables, values are expressed as medians (interquartile range); comparison between groups were performed by Mann-Whitney test, and the Spearman correlation test was applied to investigate associations between the assessed variables. The categorical variables were presented as absolute frequencies (relative frequencies), and to verify the differences between the subgroups created by the factors short rest breaks, pain complaint, and use of a chair back, Fisher's test was chosen. Statistical Package for the Social Sciences (SPSS) 13.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for all statistical analysis, and significance was assigned whenever the p value was less than 0.05.

RESULTS

Fifteen workers were enrolled in the study (Table 1). For pain complaint analysis, two participants were excluded because they did not return the questionnaire about body regions of pain complaint. Every worker enrolled in the study suffered from pain in at least one body region. SRBG and NRBG were well matched for age, weight, body composition, and other work-related behaviors (Table 2). Nevertheless, the number of body regions with pain complaints was greater for NRBG (mode = 3) than for SRBG (mode = 1).

Table 1. Characteristics of the studied sample

Variable	All subjects (n = 15)
Age (years)	32.0 (26.8–34.5)
Males (n (%))	10 (66.7)
Weight (kg)	72.2 (68.8–86.3)
Fat mass (%)	36.2 (27.7–39.9)
Seated position at work (hours/day)	9.0 (6.3–10.0)
Workday (hours/day)	10.0 (9.0–10.0)
Working years	2.9 (1.4–4.3)
Head alignment (°)	−0.5 (−2.1–2.8)
Acromions-ASIS (°)	−0.55 (−1.7–1.2)
Head protrusion (°)	40.8 (38.3–47.3)
Pelvic tilt (°)	−14.4 (−17.9–6.3)
Hip angle (°)	−8.1 (−12.7–1.5)
Computer screen height (cm)	106.6 (102.2–116.3)
Eye height when sitting (cm)	120.0 (113.3–123.0)
Leg height when sitting (cm)	52.0 (50.0–56.5)
Thigh length (cm)	56.0 (54.0–58.0)
Back without support (cm)	26.0 (17.3–35.8)
Shoulder abduction–mouse (°)	58 (45–63)
Typing elbow angle (°)	128 (117–130)
Knee angle when sitting (°)	96 (76–113)

Data are presented as medians (1st quartile–3rd quartile) for numeric values and absolute frequencies (relative frequencies) for categorical values. n = number (absolute frequency).

When comparing the groups with respect to complaints of pain in each body region, the neck and low back presented higher prevalences in the NRBG (Table 3). Furthermore, when grouping body regions, the location "neck or shoulders" also showed a higher number of subjects reporting pain symptoms in the NRBG (62.5% vs. 0.0%). The location "hands, fingers, and wrists" did not show any difference (25% for the NRBG vs. 20% for the SRBG). No other body region showed statistical differences between the groups. Considering the whole sample, the low back was the more prevalent region of complaint, followed by the neck, thoracic back, and wrist (Table 3). Considering only the upper limbs and neck, the prevalence of pain was 53.9% (n=7).

Subjects with neck complaints had worse scores for the SF-36 bodily pain domain (Table 4), smaller values for the head protrusion angle (greater protrusion in the side view) (Table 5), and were younger (median age, interquartile range: 27.5, 21.5–31.3 vs. 33.5, 31.3–40.5; p = 0.04) than those with no neck complaints. The participants with wrist complaints had higher values for shoulder angle while using a computer mouse median angle, interquartile range: 64°, 60–76° vs. 52°, 48–60°; p = 0.03).

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Table 2. Anthropometric and work-related variables for all subjects and separately for SRBG and NRBG

	All subjects (n = 15)	SRBG (n = 6)	NRBG (n = 9)
Age (years)	32.0 (26.8–34.5)	34.5 (32.5–37.3)	29.0 (26.0–32.0)
Males (n (%))	10 (66.7)	5 (83.3)	5 (55.6)
Weight (kg)	72.2 (68.8–86.3)	73.3 (59.9–94.7)	71.0 (68.6–85.4)
BMI (kg/m^2)	26.3 (21.2–29.7)	26.9 (22.4–31.1)	25.6 (20.8–28.5)
Waist (cm)	82.0 (76.1–98.4)	89.0 (72.1–99.7)	80.8 (75.6–89.1)
Fat mass (kg)	24.2 (19.1–34.1)	22.5 (18.4–35.6)	25.8 (21.5–36.3)
Fat mass (%)	36.2 (27.7–39.9)	35.1 (29.1–37.6)	39.3 (26.2–45.0)
Fat free mass (kg)	50.1 (41.2–57.8)	50.9 (41.4–59.0)	43.6 (40.5–56.2)
Seated position at work (hours/day)	9.0 (6.3–10.0)	7.5 (2.3–11.3)	9.0 (7.3–10.0)
Workday (hours/day)	10.0 (9.0–10.0)	9.5 (9.0–10.0)	10.0 (9.5–10.0)
Working years	2.9 (1.4–4.3)	3.0 (1.2–5.0)	2.8 (1.5–4.5)

Data are presented as medians (1st quartile–3rd quartile) for numeric values and absolute frequencies (relative frequencies) for categorical values.
n = number (absolute frequency); SRBG = short rest breaks group; NRBG = no rest break group; * $p < 0.05$, comparing SRBG and NRBG (Mann-Whitney test)

Table 3. Prevalence of pain complaints in each body region in the SRBG and NRBG (n (%))

Body region	All subjects (n = 13)	SRBG (n = 5)	NRBG (n = 8)
Low back	10 (76.9)	2 (40.0)	8 (100.0)*
Neck	5 (38.5)	0 (0.0)	5 (62.5)*
Thoracic back	4 (30.8)	2 (40.0)	2 (25.0)
Wrist	3 (23.1)	1 (20.0)	2 (25.0)
Knee	2 (15.4)	1 (20.0)	1 (12.5)
Head	1 (7.7)	0 (0.0)	1 (12.5)
Shoulder	1 (7.7)	0 (0.0)	1 (12.5)
Arm	1 (7.7)	0 (0.0)	1 (12.5)
Hand	1 (7.7)	1 (20.0)	0 (0.0)
Hip	1 (7.7)	0 (0.0)	1 (12.5)
Foot	1 (7.7)	0 (0.0)	1 (12.5)
Ankle	0 (0.0)	0 (0.0)	0 (0.0)

Data are presented as absolute frequencies (relative frequencies)
* $p < 0.05$ comparing the SRBG and NRBG (χ^2 test)
SRBG = short rest breaks group; NRBG = no rest break group

Table 4. Quality of life scores for the neck complaint group and no neck complaint group

Variable	All subjects (n=13)	Complaint (n=5)	No complaint (n=8)
BP domain	72.0 (41.0–84.0)	31.0 (11.0–62.5)	73.0 (49.5–96.0)*
PF domain	90.0 (75.0–95.0)	85.0 (55.0–92.5)	90.0 (68.8–98.8)
RP domain	100.0 (75.0–100.0)	100.0 (25.0–100.0)	87.5 (75.0–100.0)
GH domain	72.0 (55.0–87.0)	67.0 (48.5–69.5)	87.0 (63.3–95.8)
VT domain	55.0 (40.0–60.0)	50.0 (45.0–82.5)	57.5 (51.3–70.0)
SF domain	75.0 (50.0–87.5)	87.5 (56.3–93.8)	75.0 (65.6–96.9)
RE domain	66.7 (33.3–100.0)	66.7 (33.3–100.0)	83.3 (66.7–100.0)
MH domain	72.0 (60.0–80.0)	68.0 (62.0–82.0)	76.0 (69.0–83.0)

Data are presented as medians (interquartile ranges)
* $p < 0.05$ comparing the complaint and no complaint groups (Mann-Whitney test)
BP = bodily pain; PF = physical function; RP = role-physical; GH = general health; VT = vitality; SF = social function; RE = role-emotional; MH = mental health

Table 5. Posture alignment and workplace measurements for the neck complaint group and no neck complaint group

Variable	All subjects (n=13)	Complaint (n=5)	No complaint (n=8)
Workplace measurements			
Seated position (hours)	9.0 (6.3–10.0)	9.0 (6.5–10.0)	8.0 (3.5–11.0)
Back without support (cm)	26.0 (17.3–35.8)	49.0 (20.5–66.3)	21.5 (15.3–29.0)
Typing elbow angle (°)	128 (117–130)	127 (97–130)	130 (110–141)
Eye-screen HDIFF (cm)	10.5 (−0.8–20.2)	14.9 (9.9–28.1)	8.7 (−2.9–21.8)
Posture alignment − orthostatic position (angles)			
Head protrusion (°)	40.8 (38.3–47.3)	38.2 (35.4–38.7)*	46.1 (39.5–47.7)
Head alignment (°)	−0.5 (−2.1–2.8)	2.3 (−3.1–4.7)	−1.3 (−2.1–1.6)
Acromions-ASIS (°)	−0.6 (−1.7–1.2)	−2.0 (−2.7–1.5)	−0.2 (−1.4–1.2)

Data are presented as medians (interquartile ranges)
* $p < 0.05$ comparing the complaint and no complaint groups (Mann-Whitney test)
ASIS = anterior superior iliac spines; HDIFF = height difference.

of body regions with complaints of pain and the variables concerning body composition, posture alignment, quality of life, and work-related motivation scores showed significant correlations only for fat mass percentage ($r=0.582$; $p = 0.037$) and head protrusion angle in the right view (0.728; $p=0.003$).

The sleep positions of the studied subjects were prone position (n = 10; 66.7%) and lateral decubitus position (n=5; 33.3%). No one slept on supine position. Furthermore, there was no association between sleep position and the presence of pain in any studied body region.

The factor "use of a chair back" was associated with the prevalence of thoracic pain. The subjects who were not using a chair back when the professionals visited their workplace had a statistically higher prevalence of thoracic pain (75%) than those who were using a chair back (0%) ($p = 0.03$). No other body region presented an association between this factor and prevalence of pain complaint.

The work-related motivation scores for the whole sample were 80.0 (77.1–94.3) for the job organization subscale; 80.0 (77.1–88.6) for the performance subscale; 88.6 (74.3–94.3) for execution/power subscale and 77.1 (71.4–82.9) for involvement sub-scale. No associations were observed between work-related motivation scores and the factors short rest breaks, pain complaint, and use of a chair back.

DISCUSSION

The present data revealed that all workers enrolled in the study suffered from pain in at least one body region. The prevalence of complaints of pain in the upper limbs and neck found in this study (53.9%) was similar to that in the study of Lacerda et al.[3] (56.2%). One study from Italy[10] showed that the neck and low back were the most prevalent regions of pain (50 and 46.5%, respectively), corroborating the high prevalence found for these regions in the present study. This can be explained by the posture adopted during the workday: a high number of hours in a seated position (nine hours per day) and bending of the neck (inherent to computer use). A survey conducted in the United Kingdom[6] showed that prolonged bending of the neck was a risk factor for neck, shoulder, elbow, and forearm pain, with odds ratios for this factor decreasing markedly from the most proximal to the most distal area.

A higher prevalence of shoulder pain was expected for those subjects who frequently assume the lateral decubitus position as their sleep position, since this posture increases pressure on the shoulders. The lateral decubitus position entails a smaller area of contact between the body and the bed than the supine or prone positions and therefore a greater per unit of area pressure on this body region[23]. No association between sleep position and presence of pain in any studied body region was found probably because of the small number of subjects who adopted the lateral decubitus position.

Workplace anthropometric measurements showed similar values for thigh length when compared with those presented by Leyk et al.[24] (56 cm vs. 61 and 58 cm − the median values for males and females, respectively). The leg height when sitting was also comparable to those found by Leyk et al.[24] (52 cm vs. 54 and 50 cm for males and females, respectively).

When observing the eye height when sitting and the computer screen height, it was found that the monitors were placed slightly lower than eye height. The recommendation to lower the screen height is an issue already discussed for more than ten years ago by Burgess-Limerick et al.[4] The high values for neck extension found when a person sets a monitor higher than eye height lead to vertebra posterior compression, which could be associated with neck pain. Nevertheless, excessive neck flexion, in cases of a very low position for a computer monitor, can also be associated with pain. Data from another study showed that prolonged bending of the neck was associated with a higher prevalence of neck and upper limb pain[6]. Marcus et al.[5] included an elbow angle higher than 121 degrees as a protective factor for neck and shoulder symptoms. The median found in the present study was slightly higher than this threshold.

The association between wrist pain and shoulder abduction found in the present results indicates that this angle must be taken into consideration in ergonomics evaluations. High values for the shoulder abduction angle augment the probability for greater ulnar deviation. Marcus et al.[5] measured the shoulder abduction angle but did not analyze the association between this angle and hand pain. They only considered it as a postural risk factor for neck and shoulder pain, but no association was found. A study by Bruno Garza et al. in the USA[25] showed that keyboard activities caused higher median trapezius activity when compared with computer mouse use. Furthermore, the authors also verified that shoulder rotation varied from 25 degrees of internal rotation while using a keyboard and from 15 degrees of external rotation while using a mouse. Another study examining the keyboard use showed that without a pad, wrist extension increased 4 degrees when compared with typing with a pad to support the wrists[26].

Sim et al.[6] demonstrated that little job control and little supervisor support increased the risk of pain. These results strengthen the idea that not only physical demands cause musculoskeletal disorders. Hence, psychosocial factors at work must be investigated, as performed by the present study with quality of life and motivation at work assessments. The median motivation scores in the present study varied from 77.1 to 88.6, showing a good motivation profile for the present sample. In a study by Machado et al.[8] in Portugal, 25.8% of all the university workers that answered their questionnaire (total sample = 3,221) were unmotivated and 26.4% were dissatisfied. It is important to notice, however, that the cited study used a different method to evaluate motivation.

The median quality of life scores obtained in the present study were higher than 70 (except for the vitality and role-emotional domains). A recent statement from the International Commission on Occupational Health[9] corroborates the importance of evaluation of psychosocial factors, affirming that musculoskeletal discomfort that affects quality of life needs to be prevented. If it is already established, it must be identified and treated as soon as possible due to its high implications in the subject's life.

One limitation of the present study is that even though we assured the subjects that individual answers would not be revealed to their manager, some workers might have avoided disclosing their true condition out of fear that this could affect their jobs. Furthermore, our visit to evaluate risk factors represents only one moment in time and does not describe the whole range of postures and movements during the workday. Another important limitation was the absence of some key measurements, like the distance from the "J" key on the keyboard to the table edge, which was significantly associated with hand and arm symptoms in a study carried out in the USA[5]. The analysis of both sexes in only one group could also be questioned, but women did not present more symptoms than men in a previous study[5]. The small sample size was due to the number of workers in the studied department of the university center where this study was carried out. The authors restricted the evaluation to this department because the job tasks during the workday are similar between the measured subjects.

More studies must be carried out with other types of computer devices, like notebooks, netbooks, tablets, and mobile phones. Recently, researchers analyzed the use of notebooks[27] and the use of a touch screen in a desktop PC setting[28], but more studies are required. Furthermore, a variety of ergonomics interventions must be tested in future studies to verify their ability to reverse this pain profile in Brazilian office workers who use a computer at work, as already done in Italy[10].

For future studies, the authors' suggest a greater number of evaluated employees and investigation about the effect of an ergonomics program, especially controlling workstation measurements and adoption of short breaks during the workday.

The present study showed that complaints of pain were associated with no short rest breaks, no use of a chair back, poor SF-36 bodily pain domain, high head protrusion, and shoulder angle while using the mouse of a computer. These findings highlight the importance of ergonomics evaluations and interventions for computer workers in the workplace.

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