Work 41 (2012) 2420-2425
DOI: 10.3233/WOR-2012-0651-2420
IOS Press

Body discomfort in poultry slaughterhouse workers

Adriana Seára Tirloni[a,*], Diogo Cunha dos Reis[b], Josenei Braga dos Santos[c], Pedro Ferreira Reis[a], Ailton Barbosa[d] and Antônio Renato Pereira Moro[a,b,e]
[a]*Post-graduation Program in Production Engineering, Laboratory of Biomechanics, Federal University of Santa Catarina, SC, Brazil*
[b]*Post-graduation Program in Physical Education, Laboratory of Biomechanics, Federal University of Santa Catarina, SC, Brazil*
[c] *Post-graduation Program in Public Health, Federal University of Santa Catarina, SC, Brazil*
[d] *Department of Information Systems, State University of Santa Catarina, SC, Brazil*
[e]*Department of Physical Education, Laboratory of Biomechanics, Federal University of Santa Catarina, SC, Brazil*

Abstract. Brazil has the main producers and exporters of chicken meat, which is classified as the third largest world chicken meat producer and lead exporter. This study aimed at analyzing the body discomfort perception in poultry slaughterhouse workers and its associations with the task characteristics. The study included 290 workers, 200 women (34.7±7.7 years) and 90 men (36.8±8.2 years). A body map for evaluating discomfort and an interview regarding organizational issues and criteria of the OCRA method were used. Descriptive statistics and chi-square test ($p \leq 0.05$) were used. It was found that 87.6% of respondents performed repetitive tasks, 86.2% performed rest breaks, 82.8% performed job rotation (2-7 tasks) and 61% used tools. It was also found that 67.2% felt discomfort in at least one body region, and the symptoms most often reported were pain, fatigue and tingling. The body regions most frequently cited were: shoulders (62.6%), neck (46.2%), spine (36.4%), forearms (31.3%), arms (29.2%), wrists (25.6%) and hands (25.6%). In sectors artificially cold (n=204), 54.1% felt cold. There was no association between body discomfort and gender, task characteristics, performance of rest breaks and job rotation, use of tools and time working in the company; however, there was association with cold perception ($p=0.035$).

Keywords: Pain, ergonomics, repetitive task

1. Introduction

Brazil has the main world's chicken meat producers and exporters and currently 94% of its production is aimed at foreign trade, and in 2009 the country was ranked as the third largest producer and largest exporter [1]. However, improvements of the working conditions in this sector have not grown at the same rates [26].

According to Caso, Ravaioli, and Veneri [7], poultry slaughterhouse workers are exposed to biomechanical risk factors for the emergence of upper limb - work-related musculoskeletal disorders (UL-WMSDs), such as repetitiveness, high frequency of technical actions, excessive use of force, awkward postures, insufficient recovery time, use of tools and exposure to cold. The Occupational Safety and Health Administration (OSHA) [19] also states that work in artificially cold environments represents a risk factor for the development of WMSDs.

In a study conducted with 1744 hospital workers, a strong association between complaints with the environment temperature and upper limb musculoskeletal disorders was found (OR = 2.73, CI 95% = 2:24 to 3:33) [16]. Chen et al. [8] reported that people feel uncomfortable and are exposed to health

*Address for correspondence: Adriana Seára Tirloni, Universidade Federal de Santa Catarina - Centro de Desportos – Laboratório de Biomecânica – Campus Universitário, Trindade, Florianópolis, SC, Brazil. CEP: 88040-970; Tel. (55) 48 3721 8530; E-mail: adri@tirloni.com.br

risk factors when entering an air-conditioned environment, if the instantaneous change in air temperature exceeds the thermoregulation capacity. There is evidence that workers exposed to low temperatures have physiological reactions and these are dependent on sex (women are more sensitive to cold stress than men) and on environment temperature [3].

Comfort is defined as a subjective sensation produced when there is no localized pressure on the body, and can be assesses by a body "map" of the discomfort regions [15]. The presence of body discomfort is a symptom of WMSDs [19]; therefore, this issue is addressed in several studies [14,25,30], also including poultry slaughterhouse workers [11,17,23,28].

The OCRA method (Occupational Repetitive Actions) is composed of two tools (checklist and index) and aim to assess the risk exposure of UL-WMSDs in workers who perform repetitive movements and efforts of the upper limbs [18]. Repetitive tasks are characterized as cycles (regardless of duration) with movements of the upper limbs or repetition of the same work gesture for most of the time (over half) [12].

By analyzing the tasks of 943 poultry slaughterhouse workers, Colombini and Occhipinti [11] found that the risk of these workers was classified as intermediate and there was prevalence of WMSDs.

Therefore, the aim of this study was to analyze the body discomfort perception in poultry slaughterhouse workers and its associations with the task characteristics (repetitive and non repetitive), performance of rest breaks and job rotation, use of tools, cold perception and time working in the company.

2. Method

2.1. Participants

The study was conducted in a poultry slaughterhouse in the state of Santa Catarina - Brazil, with 3000 workers, distributed in different sectors (scalding, cutting and shipping) working in three shifts. The sectors were classified according to the type of air conditioning used in the environment: artificially cold (cutting and shipping) and natural (scalding). The environment temperature in the artificially cold sectors ranged from 10.9 to 11.5°C. The daily working time was of 08 hours and 48 minutes, with breaks of one hour for meal, 10 minutes for physiological necessities and eight minutes for worksite physical exercise.

The sample was randomly selected and occurred through a list with the names of workers. After selection, the workers were invited to participate in the study in their workplace and signed the consent form, following to a private room to be interviewed. The procedures were approved by the local Ethics Committee in Research with Human Beings, According to the Declaration of Helsinki.

The study included 290 workers, 200 women (34.7 ± 7.7 years) and 90 men (36.8 ± 8.2 years), with average time working in the company of 8.8 ± 5.0 years.

According to the Body mass index classification (BMI) of the World Health Organization for adults [31], it was found that 1.7% of workers were underweight, 56.2% had normal weight, 31% were overweight and 11% were obese, while 45.9% performed some type of regular physical exercise.

2.2. Instruments

A human body diagram for discomfort assessment was used as measuring instrument [13], in which workers should report and/or show the body region they perceived pain/discomfort. Questions regarding data to identify workers, work organization (presence of job rotation, rest breaks and use of tools) and cold perception were also used. For the analysis of repetitiveness, the workers were videotaped for one minute performing their activities using the criterion of the OCRA method [12] to classify them.

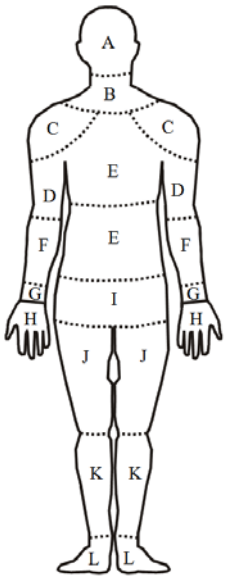
2.3. Data Analysis

Descriptive statistics was applied (mean and standard deviation) and to verify the relationship between variables, the chi-square test was used ($p \leq 0.05$).

3. Results

Based on the results obtained, it was found that 87.6% of interviewed workers performed repetitive tasks, 86.2% performed rest breaks, 82.8% performed job rotation (2-7 tasks) and 61% used tools. Moreover, it was found that 67.2% felt discomfort in at least one body region, and the symptoms most often reported were pain (84.6%), fatigue (51.3%), tingling (19.0%), loss of strength (14.4%), limitation of movement (8.7%), heaviness (13.8%) and swelling (2.1%). The body regions most frequently cited were:

shoulders (62.6%), neck (46.2%), spine (36.4%), forearms (31.3%), arms (29.2%), wrists (25.6%) and hands (25.6%) (Figure 1).



	Regions	♂	♀	Total
A	Head	1,8	2,9	2,6
B	Neck	38,2	49,3	46,2
C	Shoulders	58,2	64,3	62,6
D	Arms	18,2	33,6	29,2
E	Spine	36,4	36,4	36,4
F	Forearms	16,4	37,1	31,3
G	Wrists	20,0	27,9	25,6
H	Hands	18,2	28,6	25,6
I	Hips	3,6	2,1	2,6
J	Thighs	3,6	7,9	6,7
K	Legs	18,2	23,6	22,1
L	Feets	0	11,4	8,2

Fig. 1. Human body diagram with the identification of pain/discomfort regions reported by workers (head, neck, shoulders, arms, forearms, wrists, hands, spine, hips, thighs, legs and feet). The values equivalent to percentages according to sex (♂=55, ♀=140) and total are shown in table beside.

Of the 195 workers who reported body discomfort, 88.7% felt discomfort for a period equal to or longer than six months, 90.3% perceived increased discomfort during work and 96.4% reported that this was related to the workplace and 24.6% were making use of drugs to attenuate the symptoms reported.

As for the body discomfort intensity, it was found that 35.4% rated it as strong/very strong, 41.5% as moderate and 21% as mild/very mild, and 2.1% of workers did not mention which was the discomfort intensity.

It was found that 41.4% of workers surveyed felt cold, and among workers who work in artificially cold environments (n = 204), 54.1% felt cold. Significant association ($p < 0.001$) was found between cold perception and the type of air-conditioning used in the different sectors, and it was found that of the 120 workers who felt cold, 92.5% belonged to artificially cold sectors. The body regions most workers complained feeling cold were: hands (35%), feet (31.7%), whole body (25%), trunk (11.7%), upper limbs (6.7%), lower limbs (2.5%) and head (2.5%).

There was no association between body discomfort and sex ($p = 0.136$), the task characteristics (repetitive and non repetitive) ($p = 0.224$), performance of rest breaks ($p = 0.746$) and job rotation ($p = 0.385$) and use of tools ($p = 0.303$); however, there was association with the cold perception ($p = 0.035$).

In relation to time working in the company, it was found that 21.7% worked in the company for less than 5 years, 55.9% between 5 and 10 years and 22.4% more than 10 years, with no association of this variable with body discomfort perception.

4. Discussion

Adopting the criterion recommended by the OCRA method [12], the work in the poultry slaughterhouse analyzed was classified as repetitive, as also reported in other similar studies [7,11].

Tavolaro et al. [29] ranked the work routine in poultry slaughterhouses as stressful and tiring, and that the consequences include musculoskeletal disorders, zoonoses, skin conditions and injuries related to animals and sharp instruments.

According to Buckle [6], the appearance of disorders in upper limbs can be caused by static muscular overload, high repeatability, very short cycles and monotony of tasks.

By applying the OCRA index with 943 workers from a poultry slaughterhouse, a score of 7.7 was obtained (intermediate risk) with prevalence of 31.5% of diagnosed cases of WMSDs in 100 exposed workers and with a prevalence of 22.4 % of subjects with at least one diagnosed WMSD [11].

On the other hand, when comparing two groups of six slaughterhouse workers performing the same amount of work (48 pieces), one of the groups performing the cutting task at a speed ~ 53% higher, Christensen et al. [9] found no significant difference in physiological responses (heart rate, blood pressure, muscle activity and fatigue - EMG). The authors reported that workers who performed the cutting task at higher speed had longer breaks between work cycles; therefore, the task speed and the length of breaks (between cycles) did not influence the variables analyzed. Finally, they suggest that to reduce the physical load on the body and thereby an expected decrease in musculoskeletal disorders will be to reduce the number of pieces of meat to be deboned.

Although workers performed breaks, the lack of association between this variable and discomfort may be due to poor or inadequate distribution of recovery

periods, which according to Colombini et al. [12], are essential to prevent WMSDs and conform Burkle [6], it is a risk factor for the appearance of disorders in shoulders, arms and hands.

Colombini et al. [12] have reported that in repetitive activities, breaks should be distributed in a ratio of at least 5:1, i.e., for every 50 minutes of work, there should be a 10 minute-break for the proper physiological recovery of workers.

The lack of association between discomfort and job rotation can be related to the fact that the company analyzed has deployed job rotation only recently (three months). In addition, for the job rotation to be effective, it should be composed of diversified tasks concerning the physical demands of workers [12].

Claudon and Marsot [10] suggest the performance of preventive measures for slaughterhouse workers to reduce the risk of UL-WMSDs, and even working with sharpness knives, job rotation or micro-breaks should be included (between work cycles). The design of the knife (action of the knife blade and muscular stress in different grips) used by workers should also be observed.

Although there is no association between discomfort and use of tools, studies have shown that their use during the working day can interfere with the emergence of WMSDs [6,10,28] and that the design of the knife should be further studied [10] because, according to Buckle [6], the application of force or mechanical compression of tissues is a risk factor for UL-WMSDs.

Another important issue to be considered is the fact that workers use very sharpness knives to carry out the cutting task. Claudon and Marsot [10] found that with very sharpness knives, the electromyographic stimulation was lower in the superficial flexor muscles of fingers, biceps brachii, triceps brachii, anterior part of the deltoid and upper part of the trapezius muscles, in relation to edgeless knives; however, it remained high in the common extensor muscle of fingers. The authors suggest that knife sharpeners should be well trained so that workers perform cutting tasks with sharp knives and consequently reduce the biomechanical stress on the upper limbs.

Besides the use of tools, cold can directly influence in the appearance of UL-WMSDs and also indirectly by requiring the use of protective equipment (gloves) [6]. According to Tappin et al. [28], due to the interference that gloves exert on handgrip strength, their thickness and design change the user's sensory feedback to a tool or object. The same authors claim that the protective gloves can act as an WMSDs risk factor by increasing the magnitude or duration of grip forces applied to the knife and/or the piece of carcass being cut.

In the present study, most workers felt body discomfort and reported that the discomfort was related to the job and increased during work activities. A longitudinal study with 1800 workers from 34 different companies found that the pain perception increased during the morning, decreased after lunch and increased during the afternoon until the end of the work shift. The study also found that the peak or cumulative discomfort measured several times a day along the workday can be used as a predictor of future pain in healthy workers [25].

To minimize discomfort (symptoms of WMSDs), OSHA [19] recommends some measures such as: slowing down the production process, adoption of rest breaks and job rotation and increase the number of workers.

However, interventions to prevent absenteeism of workers with chronic pain can be achieved through the promotion of changes in the workers' behavior [30]. The authors interviewed 21 workers (9 men and 12 women) with chronic musculoskeletal pain and found that the motivating factors that caused them to remain performing their work tasks in pain were many: believing that work was a source of self-esteem, therapy, income and responsibility (with the company and co-workers). They also found that several behaviors were important and adopted by workers to avoid absenteeism: personal characteristics, coping with pain, use of healthcare services, acceptance of pain and increased behavior flexibility (in relation to capacity, to have less physical and mental overload and perform changes and adjustments in the workplace).

According to Tavolaro et al. [29], slaughterhouse workers are not specialized, have no control over their tasks, and may not be aware of the factors that can affect their health. Therefore, professionals such as veterinarians could participate more actively in the education (training) of workers and not focus only on issues such of food security.

The two regions most frequently reported by workers with discomfort were shoulders and neck. Studies have shown that cold is a risk factor for the onset of symptoms in these body regions [2,21,24].

A study submitted 12 women to repetitive work for 60 minutes in a cold chamber under three different conditions: 10°C (C), at 25°C (TN), and 10°C with clothing suitable for low temperatures (CP), and found that the vertical trajectories of shoulder, elbow and wrist joints were higher in C and CP compared with TN [22]. Furthermore, these changes were asso-

ciated with increased muscle activation (EMG) in flexor and extensor muscles of wrist, biceps brachii and triceps brachii, chest, medial part of the deltoid, upper and lower part of the trapezius muscles, suggesting that at low temperatures, changes in trajectories can be an indicator of risk to localized muscle fatigue.

The significant association observed between body discomfort and cold is reinforced by literature [5], which reports that cold contributes to increased risk of work-related diseases and accidents. Conform Tappin et al. [28], food, meat and seafood industries have to meet strict standards, such as lower and upper limits for the temperature in the boning room, which may conflict with the working conditions considered healthy and comfortable. According to the Ministry of Agriculture, Livestock and Supply [4], the temperature in the boning room should be equal to or below 12°C.

In a study conducted with 18 healthy workers in a meat cooling sector (4-10°C), no association was found between muscle stimulation of the flexor carpi radialis, extensor digitorum, medial part of the deltoid and lower part of the trapezius muscles, and the temperature of these muscles (cheek, chest, right palm, fingers, lower back, thigh and calf), concluding that the muscle strength could be related to the intensity of repetitive movements performed by workers [27].

In the study by Piedrahita [20], male workers of four meat processing industries were divided into two groups as to their thermal exposure (+2°C, n = 50; -9°C, n = 112), and it was concluded that in similar ergonomic conditions, the intensity of cold exposure was related to the prevalence of musculoskeletal symptoms, especially in neck, shoulders and back, indicating that cold is a factor that contributes to the onset of symptoms that cause musculoskeletal disorders.

Chen et al. [8] analyzed the thermal perception and thermoregulation of 16 subjects (8 men and 8 women) in response to temperature change in a thermal chamber (from 32/28°C to 24°C and from 20 to 24°C) with air velocity of 0.2m/s. Thermal perception was observed, as well as physiological properties including peripheral blood flow, skin moisture, water loss due to perspiration and skin temperature during the acclimatization period. The results showed that the thermal sensation, skin temperature and blood flow were significantly correlated with the reduction of the environment temperature to 8ºC. The authors reported that environments with different temperatures cause physiological alterations and recommend that this difference should be equal to or below 4°C.

According to Piedrahita et al. [21], actions must be done to minimize the exposure of workers to cold work environments, such as process automation, improved protective clothing and their proper use, thus reducing the risks to the health of workers.

The results of this study showed that most of the tasks analyzed were repetitive, most workers performed rest breaks, job rotation, used tools, felt cold and body discomfort, being the main complaint in the shoulder region.

Based on results obtained in this study and in literature, some organizational factors of the work in slaughterhouses should be considered for the prevention of WMSDs, such as: slowing down the production process, adoption of rest breaks well distributed along the workday, job rotation between tasks with different biomechanical requirements and increase the number of workers; the use of very sharpness knives to reduce the effort required to perform cutting task through adequate training of operators in knife honing/sharpening; use of adequate clothing to the work environment temperature and the objects to be handled, respecting the biological individuality of workers, promote thermal insulation and comfort; and finally, there should be a gradual transition between external environment and working environment, so that workers undergo adequate acclimatization.

Acknowledgements

Thanks to CNPq and CAPES-REUNI for the doctoral fellowships.

References

[1] Associação Brasileira dos Produtores e Exportadores de Frangos, Relatório anual 0910, Brasil, 2010, Retrieved from: http://www.abef.com.br/portal/_clientes/abef/cat/RA_2010.pdf.

[2] B.E. Bang, L. Aasmoe, L. Aardal, G.S. Andorsen, A.K. Bjørnbakk, C. Egeness, I. Espejord and E. Kramvik, Feeling Cold at Work Increases the Risk of Symptoms From Muscles, Skin, And Airways in Seafood Industry Workers, American Journal of Industrial Medicine 47 (2005), 65–71.

[3] A. Bortkiewicz, E. Gadzicka, W. Szymczak, A. Szyjkowska, W. Koszada-Włodarczyk and T. Makowiec-Dabrowska, Physiological reaction to work in cold microclimate, International Journal of Occupational Medicine and Environmental Health 19 (2006), 123–131.

[4] Brasil, Ministério da Agricultura, Pecuária e Abastecimento, Portaria nº 210, de 10 de novembro de 1998, Regulamento técnico da inspeção tecnológica e higiênico-sanitária de carne de aves, Diário Oficial da União, Brasília, 26 nov. 1998, Seção 1, p. 226, Retrieved: http://extranet.agricultura.gov.br/sislegis-consulta/servlet/VisualizarAnexo?id=3162.
[5] Brasil, Ministério do Trabalho e Emprego, Departamento de Segurança e Saúde no Trabalho, Minuta de nota técnica - segurança e saúde nas atividades de processamento de carnes [apostilado], Brasília, DF: MTE, 2004.
[6] P.W. Buckle, Work factors and upper limb disorders, British Medical Journal 315 (1997), 1360–1363.
[7] M.A. Caso, M. Ravaioli and L. Veneri, Esposizione a sovraccarico biomeccanico degli arti superiori: la valutazione del rischio lavorativo nei macelli avicoli, Prevenzione Oggi, 3 (2007), 9–21.
[8] C. Chen, R. Hwang, S. Chang and Y. Lu, Effects of temperature steps on human skin physiology and thermal sensation response, Building and Environment 46 (2011), 2387–2397.
[9] H. Christensen, K. Sogaard and H.B. Olsen, The importance of the work/rest pattern as a risk factor in repetitive monotonous work, International Journal of Industrial Ergonomics 25 (2000), 367–373.
[10] L. Claudon and J. Marsot, Effect of knife sharpness on upper limb biomechanical stresses - a laboratory study, International Journal of Industrial Ergonomics 36 (2006), 239–246.
[11] D. Colombini and E. Occhipinti, Risultati della valutazione del rischio e del danno in gruppi di lavoratori esposti, in diversi comparti lavorativi, a movimenti e sforzi ripetuti degli arti superiori, La Medicina Del Lavoro 95 (2004), 233–246.
[12] D. Colombini, E. Occhipinti and M. Fanti, Método Ocra para análise e a prevenção do risco por movimentos repetitivos: manual para a avaliação e a gestão do risco, LTr, São Paulo, 2008.
[13] J.A.E. Eklund and E.N. Corlett, Experimental and biomechanical analysis of seating, in: The Ergonomics of Working Postures, N. Corlett, J. Wilson and I. Manenica, eds., Taylor and Francis Ltd, London, 1986, pp. 319–330.
[14] L.A.F. Law, J.E. Lee, T.R. McMullen and T. Xi, Relationships between maximum holding time and ratings of pain and exertion differ for static and dynamic tasks, Applied Ergonomics 42 (2010), 9–15.
[15] I. Iida, Ergonomia: projeto e produção, (2 ed.), Edgard Blücer, São Paulo, 2005.
[16] N. Magnavita, M. Elovainio, I. De Nardis, T. Heponiemi and A. Bergamaschi, Environmental discomfort and musculoskeletal disorders, Occupational Medicine 61 (2011), 196–201.
[17] C.S. McPhee and H.J. Lipscomb, Upper-Extremity Musculoskeletal Symptoms and Physical Health Related Quality of Life Among Women Employed in Poultry Processing and Other Low-Wage Jobs in Northeastern North Carolina, American Journal Of Industrial Medicine 52 (2009) 331–340.
[18] E. Occhipinti and D. Colombini, Updating reference values and predictive models of the OCRA method in the risk assessment of work-related musculoskeletal disorders of the upper limbs, Ergonomics 50 (2007), 1727–1739.
[19] Occupational Safety and Health Administration, Ergonomics Program Management Guidelines for meatpacking plants, 1993, Retrieved from: http://www.osha.gov/Publications/osha3123.pdf.
[20] H. Piedrahita, Working in cold conditions indoors: effects on musculoskeletal symptoms and upper limb movements, Doctoral These, Luleå University of Technology – Sweden, 2008.
[21] H. Piedrahita, J. Oksa, C. Malm and, H. Rintamäki, Health problems related to working in extreme cold conditions indoors, International Journal of Circumpolar Health, 67 (2008a), 279–287.
[22] H. Piedrahita, J. Oksa, C. Malm, E. Sormunen and H. Rintamäki, Effects of cooling and clothing on vertical trajectories of the upper arm and muscle functions during repetitive light work, European Journal of Applied Physiology 104 (2008b), 183–191.
[23] H. Piedrahita, L. Punnett, H. Shahnavaz, Musculoskeletal symptoms in cold exposed and non-cold exposed workers, International Journal of Industrial Ergonomics 34 (2004), 271–278.
[24] D.P. Pope, P.R. Croft, C.M. Pritchard, A.J. Silman and G.J. Macfarlane, Occupational factors related to shoulder pain and Disability, Occupational and Environmental Medicine 54 (1997), 316–321.
[25] H.H.H. Reenen, A.J. van der Beek, B.M. Blatter, M.P. van der Grinten, W. van Mechelen and P. M. Bongers, Does musculoskeletal discomfort at work predict future musculoskeletal pain? Ergonomics 51 (2008), 637–648.
[26] S. Sardá, R.C. Ruiz and G. Kirtschig, Tutela jurídica da saúde dos empregados de frigoríficos: considerações dos serviços públicos, Acta Fisiatrica 16 (2009), 59–65.
[27] E. Sormunen, J. Oksab, T. Pienima, S. Rissanenb and H. Rintamä ki, Muscular and cold strain of female workers in meatpacking work, International Journal of Industrial Ergonomics 36 (2006), 713–720.
[28] D. Tappin, D. Moore, L. Ashby, D. Riley, T. Bentley and F. Trevelyan, Musculoskeletal Disorders in Meat Processing: A review of the literature for the New Zealand meat processing industry, Centre for Human Factors and Ergonomics, December, New Zealand, 2006.
[29] P. Tavolaro, I.M.T.B. Pereira, M.C.F. Pelicioni and C.A.F. Oliveira, *Empowerment* como forma de prevenção de problemas de saúde em trabalhadores de abatedouros, Revista de Saúde Pública 41 (2007), 307–12.
[30] H.J. Vries, S. Brouwer, J.W. Groothoff, J.H.B. Geertzen and M.F. Reneman, Staying at work with chronic nonspecific musculoskeletal pain: a qualitative study of workers' experiences, BMC Musculoskeletal Disorders 12 (2011), 126.
[31] WHO, BMI classification, Retrieved from: http://www.who.int/bmi/index.jsp?introPage=intro_3.html.