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Repetitive work in a dairy factory and elbow musculoskeletal disorders: Incidence, prevalence and methods for disease validation

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Abstract: The elbow is an essential joint for movement of the hand and forearm. The functionality of the upper extremity relies on elbow motion. So, the involvement of elbow in working postures is naturally high in reported occupations and work environments like food manufacturing. As consequence, the risks for the development of work-related musculoskeletal disorders (WRMSD) in this area increase considerably. The risk factors are intensified due to repetitive tasks and long working hours with few breaks. The aim of this study is to investigate the prevalence and incidence of elbow WRMSD, as well the establishment of validation methods of elbow disease, in a factory dairy products. The company has a total of 620 employees and the study was carried out between 2010 and 2014 among the 166 workers belonging to the cheese sector. Two evaluations were done, one in 2011/2012 and another in 2013/2014 and a total of 134 respondents (80,7 %) were evaluated in both. Elbow WRMSD prevalence rates achieved by self-reported symptoms, clinical evaluation and imaging, in both evaluation periods, varied between 8% and 16%. with Respect to the incidence rates of elbow WRMSD from the first to the second evaluation, the values found varied between 5% and 12%, depending of the assessment. Regarding the elbow disease validation methods, three validation methods were defined, varying the criteria sensivity and specificity. The results of this study emphasize the importance of joint evaluation of outcomes of different assessment methods.

Keywords: elbow musculoskeletal disorders, work, prevalence, incidence, validation methods.

Trabalho Repetitivo numa empresa de lacticínios e lesões músculo-esqueléticas do cotovelo: Incidência, Prevalência e métodos de validação de doença

Resumo: O cotovelo é uma articulação essencial para o movimento da mão e do antebraço. A funcionalidade da extremidade superior depende do movimento do cotovelo, e por isso o envolvimento do cotovelo em posturas de trabalho é naturalmente alto em ambientes de trabalho como o processamento de alimentos. Como consequência, os riscos para o desenvolvimento de lesões músculo--esqueléticas ligadas ao trabalho (LMELT) nesta área do membro superior, aumentam consideravelmente. Os fatores de risco intensificam-se devido a tarefas repetitivas e longas jornadas de trabalho com poucas pausas. O objetivo deste estudo é investigar a prevalência e incidência de LMELT no cotovelo, bem como o estabelecimento de métodos de validação de lesões músculo-esqueléticas do cotovelo numa fábrica de laticínios e seus derivados. A empresa tem um total de 620 funcionários e o estudo foi realizado entre 2010 e 2014 entre os 166 trabalhadores pertencentes ao setor do queijo. Foram realizadas duas avaliações, uma em 2011/2012 e outra em 2013/2014 e um total de 134 trabalhadores (80,7%) foram avaliados em ambas. A prevalência de LMELT no cotovelo através de sintomas auto referenciados, avaliação clínica e imagiologia, em ambos os períodos de avaliação, variaram entre 8% e 16%. Relativamente aos valores de incidência de LMELT no cotovelo encontrados, da primeira para a segunda avaliação, variaram entre 5% e 12%, dependendo do tipo de método de avaliação considerado. Quanto aos métodos de validação da doença músculo-esquelética do cotovelo, foram definidos três métodos de validação, variando os critérios de sensibilidade e especificidade. Os resultados deste estudo enfatizam a importância da avaliação conjunta dos resultados de diferentes métodos de avaliação.

Palavras-chave: lesões músculo-esqueléticas do cotovelo, prevalência, incidência, trabalho, métodos de validação.

1. Introduction

Musculoskeletal problems were considered the main work-related health problem in Europe (EUROSTAT, 2010). The association of the upper limb musculoskeletal disorders and work reports to the beginning of the 18th century, when the Italian physician Bernardo Ramazzini considered the “Father of Occupational Medicine”, described, in 1713, certain upper limb disorders among office clerks. He observed that a variety of common workers diseases appeared to be caused by highly repetitive movements, static working postures and stress (Buckle, 1997). These problems are still present nowadays and they are difficult to manage and to treat. As recognized by The World Health Organization (WHO), diseases are work-related when the work activities and work conditions significantly contribute to their development or exacerbation but are not the only causative factor (World Health Organization, 1985)

About 60% of Europeans make repetitive hand and arm movements (Living & Conditions, 2014) and 17% to 30% of industry workers report musculoskeletal symptoms (Woolf & Åkesson, 2001). These can explain that upper limbs musculoskeletal disorders are among the most frequent causes of occupational diseases (Work, 2009) with neck, shoulder, arm or hand problems being the most prevalent injuries, representing almost 20 % (Devereux, 1999).

The association of the musculoskeletal disorders and work, possibly, have a temporal cause-effect relation, but prevention and the early diagnosis are not valorized. This is due to the absence of information able to identify economic sectors and working conditions that increase the risk factors, but also because there is no complete knowledge of the true "size" of the problem (Torres da Costa, Santos Baptista, & Vaz, 2015). Work-related disability and illness are common in a wide range of activities, and can result in pain and reduction of work performance, absenteeism as well medical costs and compensation costs (Armstrong et al., 1993; Baldwin, 2004). According to the European Agency for Safety and Health at Work, costs are between 0.5% and 2% of Gross National Product (Devereux, 1999)

The involvement of the upper limbs in working postures is very common in reported occupations and work environments like food manufacturing, automotive processing plants and so many other manufactures (Bjelle, 1989). Despite musculoskeletal disorders are considered multifactorial disorders, they have been linked with occupational overuse. The occupational risk factors are intensified by long working hours and repetitive tasks (Nikpey, Ghalenoei, Safary Variani, Gholi, & Mosavi, 2013). In Ontario workers, the upper limb musculoskeletal disorders accounted for 26 % of lost time claims, in 2016 (WSIB, 2016).

Several risk factors are strongly related with elbow musculoskeletal disorders, namely highly repetitive movements of arms combined with handling heavy loads, nonneutral body postures, and exposure to vibration (Kaka et al., 2016; Ono et al., 1998; Rogier M van Rijn, Bionka MA Huisstede, Bart W Koes, & Alex Burdorf, 2009). According the the U.S. Bureau of Labor Statistics report, respect to the year 2007, the incidence of elbow injuries involving days away from work was 2 per 10,000 full-time workers.(BLS, 2008).

Although an increased risk of musculoskeletal disorders has been demonstrated in numerous studies in subjects carrying out intense manual work , there is still insufficient evidence to support a single relation between elbow musculoskeletal disorders and exposure to intense and repetitive work (Alexis Descatha, Leclerc, Chastang, & Roquelaure, 2003; Haahr & Andersen, 2003; Piligian et al., 2000). The large majority of

studies are restricted by the difficulty in defining diagnostic criteria and by the problems related to the validation of the measurements of exposure to the risks (Buckle, 1997)

Thus, it is revested of extreme importance the quantitative information of the exposure-response and the establishment of reliable exposure-response relationships, taking account the data obtained from many different work situations, covering almost the whole range of exposures to the risks factors (Bao, Howard, Spielholz, Silverstein, & Polissar, 2011; Fallentin, 2003; Muggleton, Allen, & Chappell, 1999). The aim of the present study is investigate the prevalence and incidence of elbow work-related musculoskeletal disorders in a factory of dairy products and as well the establishment of validation methods of elbow work-related musculoskeletal diseases. The validation methods considered suggestive elbow disease indicators based on a validated survey, physical examination by an occupational physician (orthopaedist) and from assessment of the upper limb ultrasonography.

2. The Elbow and musculoskeletal disorders

The elbow is one of the most used joints in the body. The functionality of the upper limbs relies on elbow motion, and if a person's elbow motion decreases by 50%, upper extremity damage increases by as much as 80% (Berry, 2013; Sojbjerg, 1996). It is located in the center of the arm, providing it with versatility, although it only allows flexion and extension. The elbow is a joint between three bones: humerus, radius and ulna (Figure 1). Muscles, ligaments, and tendons hold the elbow joint together. Because it has fewer planes of movement than the wrist or the shoulder, it can be painful when twisted or hyperextended and is also prone to injuries.

Figure 1. Anatomy of elbow

Reproduced from American Academy of Orthopaedic Surgeons (AAOS, 2015)

Many studies, epidemiologic and non epidemiologic, have already established that elbow disorders are associated with physical forceful occupational activities as the result of overuse of elbow extensor and flexor muscles, leading to inflammatory processes of the joint or irritation of tendon insertion (Putz-Anderson et al., 1997). An extensive review of the epidemiological evidence for work related musculoskeletal disorders has been conducted by the National Institute of Occupational Safety and Health (NIOSH) in the USA (NIOSH, 1997) where elbow injuries or disorders were included. The conclusions of the study showed that combination of work risk factors like repetition, force and non neutral

postures have a positive relationship with upperlimb musculoskeletal disorders, including elbow disorders.

Several studies with workers carrying out intense manual work support that repetitive tasks, with short work cycles involving high speed and force demanding tasks, are increased risk factors to upper limb disorders, namely elbow disorders (David, Woods, Li, & Buckle, 2008) (Latko et al., 1999; Palmer & Smedley, 2007). Activities requiring high work demands, that involve the frequent use of forceful exertions, rapid work pace, repetitive motions, and awkward postures sustained over a long period, such as leather tanning, automotive industry, construction and also food processing industry are well established risk factors for elbow (Punnett & Wegman, 2004; Werner et al., 2005).

The most common overuse syndromes of the elbow are epicondylitis, bursitis, arthritis, dislocation, fracture an infection (Morrey & Sanchez-Sotelo, 2009). Epicondylitis is the most prevalent form of disorder at the elbow, with prevalence between 1 and 5% in general population and 3% to 15% among active workers (Chiang et al., 1993; Roto & Kivi, 1984; Shiri, Viikari-Juntura, Varonen, & Heliövaara, 2006; Silverstein, Welp, Nelson, & Kalat, 1998). Epicondylitis is clinically defined by pain in the region of the epicondyle, caused by an inflammation or damage to the area of an epicondyle of bone which is provoked by resisted use of either the extensor or flexor muscles of the wrist (Harrington, Carter, Birrell, & Gompertz, 1998). This musculoskeletal disorder develop gradually. In most cases, the pain begins as mild and slowly worsens over weeks and months. Apart from the pain it causes functional impairment, and in some patients, may cause inability to work for several weeks, leading to inevitably losses of productivity (Kurppa, Viikari-Juntura, Kuosma, Huuskonen, & Kivi, 1991; Verhaar, 1994)

Epicondylitis can be divided into lateral epicondylitis, known as tennis elbow that affects the extensor muscles, and medial epicondylitis, which is known as golfers elbow, that affects the flexor muscles (A Descatha, Leclerc, Chastang, & Roquelaure; Park, Lee, & Lee, 2008). The lack of accepted criteria for the diagnoses of elbow diseases, make studies difficult to compare and, so far, there is no generally accepted method for that purpose. There are evident limitations in establishing causality with methodologies applied in numerous studies (Armstrong et al., 1993).

3. Material and methods

This study was developed in a food factory specialized in dairy products and its derivatives, in a specific production sector (cheese sector), which started activity in 2008. The company has a total of 620 employees and the study was carried out between 2010 and 2014 among all the 166 cheese sector workers. The evaluations were carried out in two moments: the first in 2010/2011 and the second in 2013/2014.

In both moments, three evaluation WRMSD methods were used:

- Application of the Nordic Musculoskeletal Questionnaire (NMQ) survey on musculoskeletal symptoms (Kuorinka et al., 1987) translated and validated for the Portuguese population (Serranheira, Pereira, & Santos, 2003) with assisted response;
- Physical examination performed at their local occupational medicine department;
- Ultrasound imaging of the upper limbs.

The main objective of the application of NMQ as indirect method (Gómez-Gaián, Pérez-Alonso, Callejón-Ferre, & López-Martinez, 2017), was the identification of musculoskeletal complaints or symptoms in the professional group of the study. This method serves to the screening of musculoskeletal disorders in an ergonomic

context, and as instrument for occupational health care service (Crawford, 2007). It presents multiple-choice questions, structured in two well-differentiated parts. The first part, the general one, refers to symptoms in 9 parts of the body (neck, shoulders, elbows, wrists/hands, upper back, lower back, hip/thighs, knees, and ankles/feet) during the last 12 months/7 days beforehand. The second part, the specific one, refers to symptoms throughout the subject's working life. In this study, complementary information as individual characteristics and work history including questions of age, anthropometry, gender, duration of employment, and previous jobs held, were also taken into account. Personal psychological factors were not included in this questionnaire. All the works that agreed participate in the study, were asked to sign a consent form.

Respect to the physical examination, an orthopedic examination of the upper limbs was performed by an orthopaedist doctor, to all participants, in both evaluation periods. To complement the physical examination, ultrasound scanning was performed. With the technological advances, the clinical application of diagnostic ultrasonography (US) has spread across various medical specialties, included Orthopaedics and Traumatology. The real time images captured, can show the structure and movement of the body's internal organs, as well as blood flowing through blood vessels, which are very valuable to help diagnosis of tendon tears, muscle tears, and tendon and nerve subluxations or dislocations. It is also a quick and easy method for side-to-side comparisons (Lew, Chen, Wang, & Chew, 2007).

Despite ultrasonography is not a typical choice for elbow disorders imaging is useful to diagnose soft tissue diseases of the elbow (Berry, 2013; Levin et al., 2005). Due the absence of radiation exposure, availability, low cost and patient friendly examination, US was selected as method for elbow imaging in this study.

A total of 134 respondents (corresponding to a rate of participation of 80,7%) participated in both evaluation periods defined for this study: one in 2011/2012 and another in 2013/2014. To help identify features of the job which might be associated with WRMSDs a control group of 401 non-production workers without repetitive work were also included in the study, but at this group only the Nordic Questionnaire survey was applied once. The statistical analyses presented in this study were performed using statistical software SPSS version 22. The data doesn't follow normal distribution, so the variables were analyzed with non-parametric tests. The categorical variables were tested with Pearson's chi-squared test and with 95% confidence interval with a level of significance of $p<0.05$.

4. Results

4.1 General characteristics and working profile of participants

From the 134 participants of the study, 41 (30.6%) were male while 93 (69.4%) were female, aging from 20 to 61 years old. with Respect to working profile, 80% of the participants worked for less than 8 years in the factory, and 94% of the workers are right-handed. Demographic characteristics of participants and control group are summarized in tables 1 and 2.

Table 1. Demographic characteristics of participants and control group

	Cheese factory workers	Control Group
Variable	**Mean ± Standard Deviation**	**Mean ± Standard Deviation**
Age	32.42 ± 7.6 years old	30.00 ± 9.8 years old
Height	1.65 ± 0.09 m	1.71 ± 0.09 m
Weight	67.63 ± 13.5 kg	68.22 ± 12.6 kg
BMI*	25.99 ± 7.63 kg/m^2	23.22 ± 3.30 kg/m^2

** Body Mass Index.*

Table 2. General characteristics of cheese sector participants

Variable	Percentage (%)
Smokers	28,0
Non smokers	72,0
Age Groups (Years)	
19-30	53,0
31-40	23,1
41-50	18.7
51-60	5,2
Work Stations	
Supply of raw materials; Pressing and Moulding	18,7
Salting and Maturing	20,1
Packing	39,6
Others	21,6

4.2 Prevalence of elbow WRMSD disorders

In the first evaluation, the total prevalence of symptoms of elbow work-related musculoskeletal disorders was of 11,2% and the point prevalence in the second evaluation was 8,2 %. In terms of gender, women reported more elbow musculoskeletal symptoms than men (93,3% vs 6,7% for men). Regarding the clinical orthopedic examination the prevalence was 13,4 % and 7,5%, respectively for first and second evaluation. Taking into account only the results of ultrasonography which was made in both evaluation periods, the prevalence was of 8,2% and 15,7% respectively. The results are presented in Figure 2 and Figure 3. With respect to the control group, was found a shoulder work-related musculoskeletal disorders prevalence of 3,2 %.

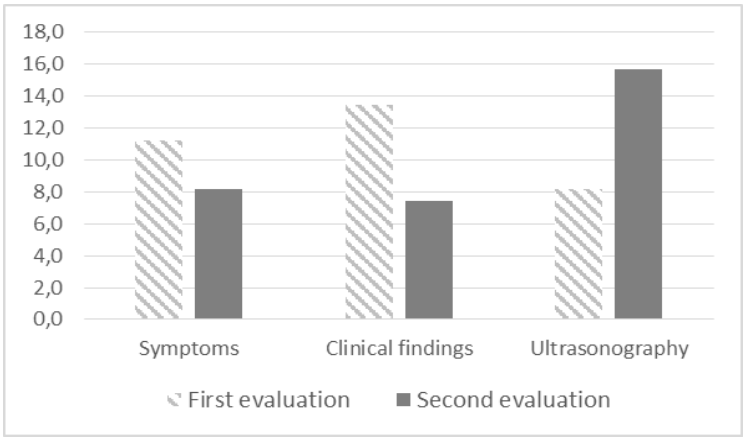

Figure 2. Prevalence in both evaluation periods (cheese sector participants)

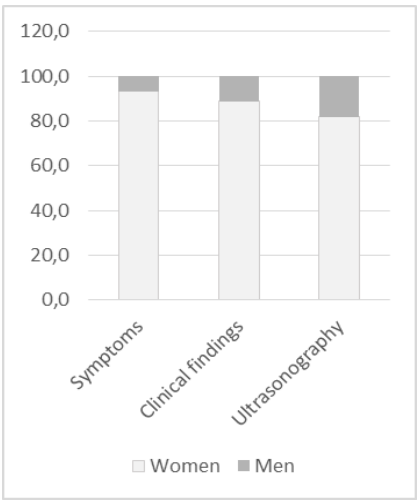

Figure 3. Prevalence by gender in first evaluation period (cheese sector participants)

As shown in Figure 4, the major disorder diagnosed by the orthopedist was epicondylitis (83,3%). Among others are neuropraxia of the elbow.

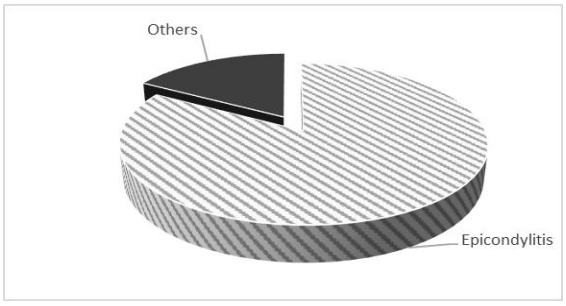

Figure 4. Type of elbow disorders found in the study

4.3 Incidence of elbow WRMSD disorders

Over the follow-up period, there were 7 new cases of elbow symptoms, 4 new clinical findings by the orthopaedist and 16 new abnormalities found in ultrasonography, giving rise to a period incidence rate of 5,2%, 3,0% and 11,9%, considering symptoms, clinical findings and ultrasonography, respectively (Figure 5).

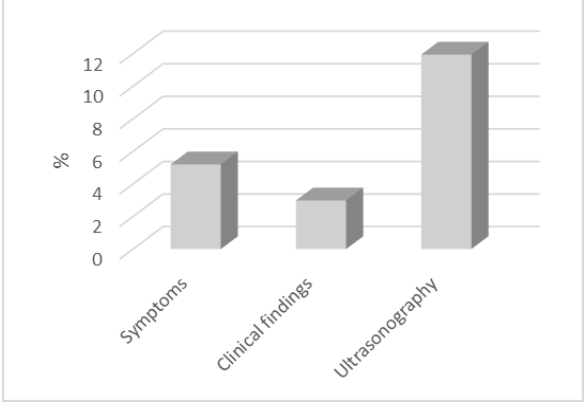

Figure 5. Incidence over the follow-up period

Furthermore, the cases that disappeared were accounted, considering the three evaluation methods of the study. Thus, 11 respondents became asymptomatic (8,2%), 12 clinical findings disappeared (9,0%) and 6 ultrasonography abnormalities became normal (4,5%), as showed in Figure 6.

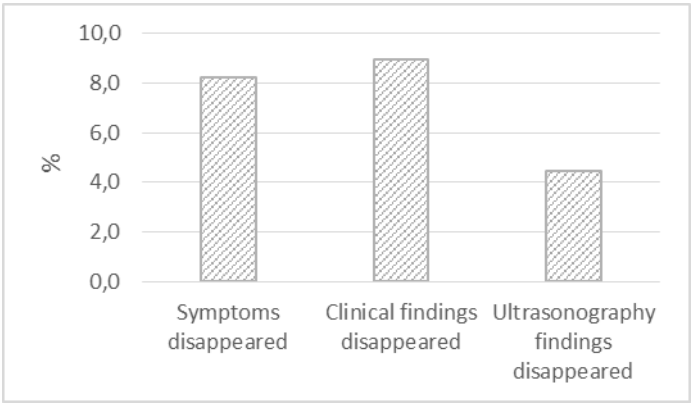

Figure 6. Percentage of cases that disappeared, by the evaluation methods of the study

Considering ultrasound in particular, a statistical analysis was made of the findings. So, can be observed that 3,7% of the findings achieved in first evaluation period remain in the second evaluation, and of these 60,0% are exactly the same, while 40,0% change (Figure 7).

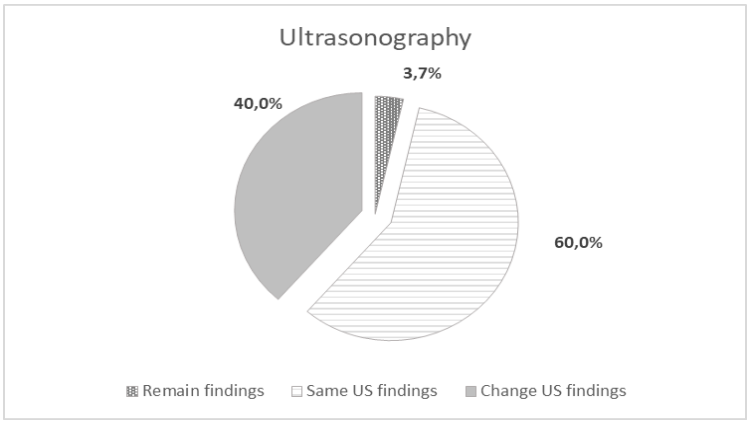

Figure 7. Percentage of US findings remain

4.4 Relationship between the prevalence of elbow musculoskeletal disorders using the different evaluation methods and variables

The relationship between the prevalence of elbow musculoskeletal disorders using the different evaluation methods (perceived symptoms, clinical findings and elbow ultrasonography) and the variables participant's gender, age group, body mass index (BMI), years of service in the company, years of service, workplace and smoking habits was assessed by Chi-square test (Table 3). The significant associations verified were perceived symptoms with gender ($p=0.033$) and with age group ($p=0,007$), clinical findings with the number of years of service in the company ($p=0.035$), and ultrasonography imaging with age group ($p<0.001$) and with smoke habits ($p=0.033$).

Table 3. Association between the prevalence of elbow musculoskeletal disorders using the different evaluation methods and some variables, in first evaluation period

Variable -	Symptoms p value	Clinical findings p value	Ultrasonography p value
Gender	0.033*	0.054	0.351
Age group	0.007*	0.363	**
Body Mass Index (BMI)	0.282	0.398	0.767
Years of service in company	0.152	0.035*	0.08
Years of service in cheese sector	0.184	0.197	0.758
Workplace	0.435	0.219	0.907
Smoke habits	0.484	0.583	0.033*

** Significant value (p<0.05) **p<0.001*

For a better elucidation about the associations described, the most prevalent groups with elbow musculoskeletal disorders, are described in terms of percentage (Table 4), considered the three evaluation methods applied.

Table 4. Most prevalent groups with elbow musculoskeletal disorders, considered the evaluation methods applied.

Variable	Methods		
	Symptoms	Clinical Findings	Ultrasonography
Gender	Women (93.3 %)	Women (88.9 %)	Women (81.8 %)
Age group	41-50 years old (46.7%)	19-30 years old (38.9%)	41-50 years old (54.5%)
Years of service in company	> 5 years (33.3 %)	> 5 years (38.9 %)	> 5 years (45.5 %)
Years of service in cheese sector	3 years (60 %)	4 years (50 %)	4 years (54.5 %)
Workplace	Packaging (53.3 %)	Packaging (50.0%)	Packaging (27.3 %)
Smoke habits	No smokers (80%)	No smokers (77.8%)	No smokers (100%)
Body Mass Index (BMI)	Normal weight* (66.7 %)	Normal weight* (72.2 %)	Normal weight* (54.5 %)

**BMI considered normal weight is between 18.5 and 24.9*

The association between the first and the second evaluation, related to the evaluation methods selected for this study was also accessed (Table 5).

Table 5. Association between the evaluation methods in both evaluation periods

Variable	p value Sint
Symptoms 1ª evaluation vs Symptoms 2ª evaluation	0.006*
Clinical findings 1ª evaluation vs Clinical findings 2ª evaluation	**
Ultrasonography1ª evaluation vs Ultrasonography 2ª evaluation	0.005*

** Significant value (p<0.05) **p<0.001*

4.5 Validation methods of elbow WRMSD disorders

Finally, in order to analyze the possible presence of work-related wrist/hand musculoskeletal disease, suggestive elbow disease indicators were used, based on the clinical examination, and upper limb ultrasonography. The establishment of validation methods of elbow work-related musculoskeletal disease, is based in groups representing positive response in the evaluation methods considered.

Therefore, three evaluation methods and four groups were considered. The evaluation methods were: symptoms; clinical examination and upper limb ultrasonography. And the groups were named as Group A, B, C and D, which represents

positive response to elbow disease in one, two, three, or in any of the methods, respectively. The Table 3 resume the results.

Table 6. Group's percentage representing positive response of wrist/hand disease

Groups	% (2011/2012)	(%) 2013/2014
A: Signs of disease in one of the methods	14,9	13,4
B: Signs of disease in two of the methods	6,7	4,5
C: Signs of disease in three of the methods	2,0	3,0
D: No signs of disease in any method	76,9	79,1

5. Discussion

The present study corroborates that there is strong evidence that activities involving forceful arm movement, prolonged static muscle loading in the elbow area, very often present in manufacture industries, increases risk of shoulder musculoskeletal disorders (Alrowayeh et al., 2010; Bohr, 2011; Buckle & Devereux, 2002; Herquelot et al., 2013; Kaka et al., 2016; Viikari-Juntura et al., 1991). The schedule of a dairy factory processing industry worker involves a series of events such as suppling raw material, moulding, salting, moulding and packing. These activities involve the frequent use of forceful exertions, repetitive motions, rapid work pace, and non-natural body postures sustained over a long period. So, the expected prevalence and incidence of elbow WRMSD disorders were high, considering a population highly exposed to repetitive work (Amell & Kumar, 2001; Nordander et al., 2013)

In fact, elbow WRMSD prevalence rates achieved by self-reported symptoms, clinical evaluation and imaging, in both evaluation periods, varied between 8% and 16%, in the three methods applied. These results are consistent with other studies in manufacturing industries, reporting elbow WRMSD prevalence of 3-15%. (Dimberg, 1987; Juul-Kristensen, Sogaard, Stroyer, & Jensen, 2004; Klussmann, Gebhardt, Liebers, & Rieger, 2008; Kryger, Lassen, & Andersen, 2007; Ono et al., 1998)

Depending of the outcome measured the prevalence change. In this study the prevalence increase when the assessment was made by clinical findings, in the first evaluation, and when it was made by US, in the second evaluation. This can be explained by the increase of specificity or by the the underestimated symptoms perceived by workers and/or decision not to report those symptoms in the survey.

In terms of gender the prevalence of self-reported WMSD was higher for women than for men, which agrees with what is described in literature (Juul-Kristensen et al., 2004). In this study it could be explained because the proportion of female population in the factory is substantially higher than male, but also because women may be more likely to express pain and symptoms comparing with men or even the shorter muscles in women (Fagarasanu & Kumar, 2003).

Regarding the results obtained by ultrasonography, as this method can detect a variety of asymptomatic elbow abnormalities, and detect several "abnormalities" that may be clinically unrelated to the patient's complaints it would be expected to have the highest prevalence value of the three methods used in the present study. However, this was only verified in the second evaluation. In the first evaluation the ultrasonography prevalence values were smaller than expected, when compared with clinical findings. It could by explained by the difficulty of the ultrasound waves to penetrate bones and, therefore, can see only the outer surface of bony structures and not what lies within. For the visualization

of internal structure of bones or certain joints, other imaging modalities such as Magnetic resonance imaging (MRI) could provide more detail.

To access with more certainty the effect of work conditions in the development of elbow disorders, a control group was included in the study, without exposure to the same risk factors than cheese factory workers and the symptoms prevalence of this group (3,2%), was lower than cheese factory workers symptoms prevalence as expected. The prevalence value achieved, agrees with the prevalence of elbow injuries reported in others studies in no manufacturing industries, like third sector jobs, and in general population estimated in 1 to 5% (Chesterton et al., 2009; Hamilton, 1986; Ono et al., 1998).

Regarding the most common disorder encountered in this study, epicondylitis appeared to be the most prevalent, with 83,3% of the elbow disorders (corresponding to 11,1% of the total of participants). These findings agree with several studies (Chiang et al., 1993; A. Descatha, Dale, Jaegers, Herquelot, & Evanoff, 2013; Roquelaure et al., 2006; Roto & Kivi, 1984) reporting epicondylitis as the most common injury related with several tasks that overuse the extensor and flexor muscles of the elbow, like handling heavy loads, activities with use of vibrating tools, high repetition tasks and awkward postures (Fan et al., 2009; Haahr & Andersen, 2003; Kryger et al., 2007; Mens, Stoeckart, Snijders, Verhaar, & Stam, 1999; Shiri et al., 2006; R. M. van Rijn, B. M. Huisstede, B. W. Koes, & A. Burdorf, 2009). Even so, epicondylitis is only recognized as occupational disease in four European member states. It should be noted that Portugal is one of these states (France, Luxemburg an Finland are the others) (EODS, 2000).

The risk of development of elbow WRMSD, is measure by the incidence rate. Over the follow-up period, incidence value was between 5% and 12%, depending of the method considered. These values are in agreement with some literature studies which report incidence rates between 1% and 11% (Kurppa et al., 1991; Roquelaure, Descatha, Dale, Silverstein, & Rempel, 2015). Despite the large number of studies of upper limb disorders, there are only a few that describe the outcomes assessed by more than one or two methods (surveys mainly) and relates them together.

One of the objectives of the study was to define methodologies for the validation of musculoskeletal disease of the elbow, and the defined groups enabled to link the three methods information. So, to use criteria with high degree of sensivity, leading to the detection of the disease in earlier stages of development results of group A should be taken into account. In turn, if the criteria is having a high degree of specificity, results of group C should be considered.

6. Conclusions

The considerable heterogeneity between elbow musculoskeletal disorders studies settings as well the adoption of a widely different methodologies, exposure assessment and statistical approaches make comparison and interpretation of findings difficult. Although the results obtained in this study are in agreement with most similar studies, there are discrepancies with other studies. It should be take into account that, in elbow disorders, pain can be present without any clinical sign, and workers may meet clinical criteria without experiencing any pain at all. Neverthless, this study reafirm the importance of association between work related factors, like repetitive and forceful movements and elbow musculoskeletal disorders.

The findings of this study highlighted also the importance of the joint evaluation of different assessment methods. The combination of methods provides more realistic

information. The use of only one assessment method could explain, in part, some variances in prevalence rates observed in the literature. The high prevalence and incidence rates found in the present study, underlined, the importance of having WMSDs education and prevention programs, as well including the need of an improved medical routine surveillance, and better ergonomics in the workplace.

This study reinforce the importance of establishing appropriate and consensual diagnosis criteria that allow a better comparison of the results. Nonetheless, more research is required in understanding the relationships between different assessment methods, around the cost-effectiveness of the different strategies and at the prevention or treatment field. Some limitations could be discussed however, including the small participants number, that should be higher or the study design provided no information on events during the two years of follow-up. It would be better if there were more examinations between. That may be a limitation, given the rapid evolution of these disorders.

7. References

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