136 - ERGONOMICS IN PREVENTION OF WORK ACCIDENTS: THE FORESTRY SECTOR CASE.

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1. Introduction:

The industrial activities were modified with the Industrial Revolution, leading to adjustment of employee working conditions, considered true premise in that period, where conditions were poor in the workplace, Pilatti to address this issue states that:

The conditions of work and life were spoiled in a certain way that it achieved levels inhuman. The houses were inadequate and did not have the minimum conditions of hygiene and cleanliness. The food was very poor. The infrastructure of cities was insufficient to meet the emerging needs. (2007, p. 4)

However, the workers developed their activities, each one carrying a unique role in the productive sector, applying a reduced occupational biomechanics with regard to body movements, with great physical consuming and many accidents at work. For this season what mattered were the positive results of production and not the needs of workers.

After the period of the industrial revolution and, with the upgrading of machines, the industry needed to adapt to new requirements in the competitive market. Technological advances occurred in the last century, according to GUTIERREZ (2006, p. 92) had its aspects as much economics as legal "it is therefore the gains as the eight hours daily, the right to paid vacation, leave and bonuses ".

The reduction of working hours could be rather an improvement in Quality of Life at Work, provided that such work does not continue to be developed in insecure environments and conditions and security guards with dubious.

To secure the rights to the workers, in 1972 it has been created the regulatory standards related to safety and health of the workers, who had his record in the Consolidations Labor Laws dating from 1943.

To Kitamura (2005) two of the standards of the Consolidations Labor Laws received prominence in promoting safety and health of the worker, the NR 7, and number 9, each respectively deals with issues related to the Medical Program for Control of Occupational Health called the PCMSO, Disaster Prevention Program Environmental Risk called PPRA, which received the apparatuses standards of numbers 15 and 17.

The industries over the need to address the labor standards sought improvements in the local labor market, among the Labor Regulatory Norms of the No. 17, mentioned earlier, deals with the normalization of Ergonomics. In this standard are the parameters for the updating of work to the psychophysiology characteristics of workers, taking as its aim to provide a maximum comfort, efficient performance and safety in the workplace.

The objectives of this standard answer all the questions regarding the needs of workers contributing to the Quality of Life at Work (QVT), this theme has been advocated by Walton since 1973, where he already had the main topics for the improvement of QVT, which addressed eight items, among them, the number two, safe and healthy working conditions.

Many industrial activities already reported, shows that the incidence of problems related to work were discovered just some time later as Kitamura reports (2005, p.48) when talking about issues related to young wipers of chimneys in 1775 by the doctor Percival Pott “knowledge of that the soot from chimneys contained substances which today are considered to be cancerous and came much later in 1930 "

The work environment with its characteristics according to the activity of production carry on their way products, materials and substances that can lead to compromising the health of the worker, therefore, it's required periodic examinations where besides the clinical examination, it is important to know details of the labor activity as well as details of the workplace, in order to be registered and reported in the medical histories of the worker. According to Kitamura it should not "forgetting to include the minimum information about the working conditions and the environment in which this work is developed" (2005, p48).

The list of the minimum data about the work place is needed not only to the doctor, but for all sectors of industry, to get the necessary improvements, thus preventing work accidents and improving the QVT. To cover this item, the industries, seek remedies in relation to the prevention of accidents, and the Ergonomics is one of them and it has been used each day daily.

The Ergonomics has three levels of challenge in the industry as follow: the level of technical systems, the level of production system and the level of the working condition where safety must be present. Accidents happen because of the unsafe acts of work that after an Ergonomics Analysis of Labor must be solved.

This paper aims to show the changes in the process of working in a sector of a timber company in the region of Santa Catarina, after a Labor Ergonomics Analysis (AET).

2. Ergonomics

The word Ergonomics derives from two Greek words: Ergon, meaning work, and Nomoi, meaning natural laws which that literally means the labor laws. (Nascimento & Moraes, 2000). The Ergonomics has characteristic multidisciplinary being in charge of studying the activities of persons with the aim of adjust products, systems, the jobs involving the characteristics of users.

When it comes to ergonomics it necessarily appears three points, comfort, efficiency and safety. The ergonomics is defined as a body of scientific knowledge relating to humans and necessary for the design of tools, machines and devices that can be used for maximum comfort, safety and efficacy. (Wisner, 1987). To the Brazilian Association of Ergonomics, the ergonomics is integrated with the people, technology, organization and the environment where the speeches must have the objective of improving, always taking into consideration the safety, comfort, welfare and effectiveness of human activities.

In the ergonomics process, we find a special feature for the ergonomics with the same being divided into Ergonomics in Design, Ergonomics of Correction and Ergonomics of Awareness. The Ergonomics of design is when the ergonomics contribution is made during the initial phase of the project, the product, machine or environment. The Ergonomics of correction is applied in the real situation to resolve existing problems that are reflected in security, the fatigue, in diseases of the worker or the quantity and quality of production. The Ergonomics of awareness is when the problems are not completely resolved neither at the design stage not at the stage of correction, when new problems arise or in the introduction of new equipment or methods.

The beginning of the use of ergonomics considered by Iida (2005) was in prehistoric times when the caveman updated their weapons for their survival. In the First World War it has been established the Commission of Health of Workers then moved on to Work Health Research Institute. With the time it was incorporated a scientific matrix, where knowledge institutes were created to analyze the labor activities. During the Second World War there was a need to adapt the military instruments, thereby facilitating the

performance of the soldier, reducing the level of tension and reducing the risk of accidents.

The Ergonomics has its official date of origin "as opposed to many other sciences whose origins are lost in time and space, the ergonomic has an official date of birth on July 12, 1949." (IIDA 2005 p.05). In England arises in 1950 the Ergonomics Research Society, a Society of Researcher whom showed the study of the work environment, thus the ergonomics was being spurred by the world, improving the living conditions of workers.

In Brazil, on August 31 of 1983, it was created the Brazilian Association of Ergonomics (ABERGO). On November 23, 1990, the Ministry of Labor and Social Welfare established the Ordinance No 3751 which established the Regulatory Standard 17, NR - 17, which deals specifically for Ergonomics. The NR17 according to the Ministry of Labor "is to establish parameters that allow the adjustment of working conditions according to the psycho-physiological characteristics of workers in order to provide maximum comfort, safety and efficient performance" (NASCIMENTO & MORAES, 2000 p.64) . The ergonomics is an interdisciplinary study through the relationship of man with the work place.

Currently the ergonomics covers five major areas of study applied to work, ergonomics in the organization of heavy labor, the biomechanics applied to work, the prevention of fatigue at work, the prevention of human error and ergonomic suitability of the job. (Couto, 1995).

To reach the ergonomic goals, data are needed as the physical, physiological and the social worker characteristics, and the age, sex, training and motivating influence in drafting the report. The issue of machinery used to perform the job, the facilities and conditions of the local workforce are very important. In the physical environment should be analyzed, temperature, noise, vibration and light, items which are part of the PPRA NR9. Other factors such as information, which is the communication between the elements of a system and ways which it passes the information, and processing of decisions, as well as the time, shift work and fatigue in the workplace must be taken into account for the ergonomics reports.

The ergonomic analysis of work (AET) uses the knowledge of ergonomics to examine, diagnose and correct a real situation at work. When it comes to the realization of the AET, three tests are important: the demand, the task and activity at the workplace. The demand is "the description of a problem or a problematic situation that justifies the need for an ergonomic action." (IIDA, 2005 p.60). The task is what the worker must perform and the technical environmental conditions and organizational of this achievement, and the activity is what the worker actually performs to execute the task, taking into consideration the analysis of the behavior of man at work.

3.Methodology

The study was conducted through the field research of the quantitative and descriptive type, which is a type of research used with the aim of achieving information and / or knowledge about a problem, for which we demand an answer, or a hypothesis, which we want to prove, or even discover new phenomena or the relations between them "(LAKATOS and MARCONI 2001, p.186). The work has as its characteristic a case study, the case study as Yin (2002), it's a way to do research.

The method of assessing the post was as follows, analysis of the demand, which is the number of workers needed for the job; analysis of the task, which should be detailed taking into account the work environment, and analysis of the activity, which covers all items related to the work environment, physical characteristics of the worker and labor fatigue.

The study was performed at the work place, it was applied the check list's for the ergonomic condition of the working method, for the biomechanics of the general production post, for the ergonomic condition of the job and the degree of repetitiveness of the task.

The analysis through pictures was used to indicate the possible ergonomic risks; the repetitiveness issue it was evaluated the cycle task. To determine the energy, we used the Lehman method which determines the expense of calories through the working class and the posture adopted. To invest the attitude of the employees it was used two methods, use of the check list models COUTO & RULA that determines whether the stance is acceptable, if it's needed to investigate, if it's needed to investigate soon or if it has to investigate and change immediately.

For the anthropometric evaluation it was used tape measure where average values were obtained in the sector of the population assessed, taking into consideration as a theoretical basis the German Standard called Deutsches Institut Für Normung (DIN 33,402). This rule provides points of reference in assessing the heights and lengths of work.

For the case study it was chosen the post known as Second Hedge at a farm of Timber Company in the region of Santa Catarina. That job contains in its entire eight employees to carry out the activity being divided by plantation area, the work time is 08:00am to 06:00pm.

4. Analysis of the job: a case study.

During the task the worker notes the trees which should be pruned and that pruning is over a meter and a half from the ground, thus needing a ladder to work. The means of implementing the task is through the help of the ladder and a pair of scissors that makes the cutting of the branch near the trunk.

In Ergonomics Analysis of Labor (AET), it was found that the employee remains in inappropriate positions subject to fall, your job is to hold the second cutting of the trees in a plantation farms of the company, leaving the worker placed under a wood ladder supported by the tree, keeping his body in direct contact with the trunk and branches where there may be venomous animals, such activity is performed in standing posture, which leads to an energy expenditure through the table of Lehman of 320 kcal.

Postures as lifting the arm above 90 degrees, abduction and rotation of the trunk are made constantly during the working day and must be neutralized the biomechanics, with the application of the biomechanical analysis applied to the study, proposed by Couto (1995), continuing to AET, it becomes clear the static contractions of the upper and lower limbs, thus establishing the check-list of RULA that biomechanics should be changed immediately. As there is a risk of contact with venomous animals, the risk of falling is evident, since the official to avoid the bite, has the reflection of jumping the ladder and must again resort to general ergonomic suitability of the job (Couto, 1995).

For this job the need for an ergonomic action is clear, therefore, has a problematic situation, and when that reality of demand is evident, the ergonomics should be used for one of the two classifications in order to improve (Iida, 2005).

On the following pictures 1 and 2, you can check the postures found during the AET in the sector chosen for the case study.



Picture 1



Picture 2

Posture work evidenced during AET. Source: authors of the research.

As we can see on the pictures number 01 and number 02, it is evident dynamics positions of the upper limbs and static to the lower limbs, there is a bending of knee and hip of the worker around the trunk of the tree, there are also static contractions of the quadriceps and calf muscles and repetitive movements when he performs the movement to cut the branch with the scissors. The extent of cervical is also evident during the working day.

To address the goals of ergonomics, it was necessary after the AET, an ergonomic, through the first step (phase) which is the transformation of primitive conditions, (Couto, 1995).

The workers can not always distinguish what is the best labor posture, thereby necessitating an AET, to have an ideal biomechanics, Veronesi (2008, p. 52 and 53) to describe the steps for ergonomic intervention mentions:

There is no doubt that the majority of workers run their activities in an early labor, without any comfort or method of application, feeling pain during the day and recovering partially at night, and often can not identify that the working conditions are very bad because they do not know anything different.

Seeking to improve ergonomics, the working method for the job of this research was switched, as shown in pictures of numbers 3 and 4:



Picture 1



Picture 2

Posture after AET. Source: authors of the research.

On the pictures of number 3 and 4, we can see the new attitude to the process of the activity of the second pruning, and the employee remains all the time in contact with the ground thus avoiding the fall of the ladder and also the contact with venomous animals which remaining in the trunk and branches of the trees.

The biomechanics is improved by keeping the body upright without the inflections of knees and hips and no isometric contractions of the muscles of the calf, thus decreasing energy expenditure and respecting the use of the body at work (Veronesi, 2008). The means of implementing the task has also been altered and used a saw attached to a long stick of wood instead of scissors that was previously used to cut the branches and was applied with great handling.

Other measures such as pause and guidelines for the conduct of exercises compensatory, which is the objective of relaxing the muscles used during the working day were included in the work day to make up for a standing posture and extension of neck. The worker uses all the individual protective equipment required for this activity. After the establishment of the new method of working the rate of falls was null and the accidents with venomous animals too.

5. Final considerations:

After verification and detailed observation of the activity performed by the worker, is that it is possible the achievement of ergonomic analysis. The ergonomics becomes crucial in the workplace; where an ergonomic analysis of the work must have as its aim all the assumptions of activity performed by the worker.

Upon completion of the Ergonomics Analysis of Labor (ETA), some using search engines such as the ergonomic check-list model Couto and RULA that evaluates the biomechanics of posture and the metabolism table of Lehman which indicated that an energy expenditure of 320Kcal / h, was shown that these tools are important to scientifically rely the statements of risk and energy expenditure.

When you make an AET, however, you can see that studying the environment and working conditions go beyond the simple application of the check-list. The perception of the evaluator professional, the experience in knowing the work, and all the relevant information in this way should be clear, as well as the equipment for the environmental assessment should provide support, enabling a real definition of the situation.

To achieve the greater goal of AET, which is to improve the work environment and "transformation of primitive conditions which accounts for 80% of ergonomic solutions commonly applied in enterprises" (VERONESI, 2008, p. 52), giving the employee the maximum security of comfort and satisfaction in performing the tasks, is not enough just the application of certain tools, being necessary other means to elucidate the possible problems encountered in the workplace.

The result of this study demonstrates the great importance of ergonomic analysis of the work in order to change the method of work and improvement in quality of life of the employee.

6. References:

COUTO, H. **Ergonomia Aplicada ao Trabalho:** Manual Técnico da Máquina Humana. vol. 1, ERGO Editora, Belo Horizonte, 1995.

_____ **Ergonomia Aplicada ao Trabalho:** Manual Técnico da Máquina Humana, vol. 2, ERGO Editora, Belo Horizonte, 1995.

GUTIERREZ, G. L, ALMEIDA, M. A. B. de. **Conflito e gestão da QV nas organizações**. In: VILARTA, R. e organizadores. **QV e fadiga institucional**. São Paulo: IPES Editorial 2006.

IIDA, I. **Ergonomia projeto e produção.** 2ed. Editora Edgard Blücher. São Paulo: 2005.

KITAMURA, S. **O ambiente e as condições de trabalho e a qualidade de vida**. In: GONÇALVES, A e organizadores. **Gestão da QV na empresa**. Campinas SP. IPES Editorial: 2005.

LAKATOS, E. M, MARCONI M. A. **Fundamentos da Metodologia Científica.** 4.ed rev. e ampl. Atlas. São Paulo: 2001.

NASCIMENTO, N M. MORAES, R A S. **Fisioterapia nas empresas**. 2ed. Taba Cultural. Rio de Janeiro: 2000.

PILATTI, L. A. **QV e Trabalho: Perspectivas na sociedade do conhecimento**. In: VILARTA, R. e organizadores. **QV e novas tecnologias.** Campinas, SP. IPES Editorial: 2007

VERONESI Jr, J. R. **Fisioterapia do trabalho: cuidando da saúde funcional do trabalhador**. Andreoli. São Paulo: 2008.

WALTON, Richard E. Quality of Working Life: What Is It? **Sloan Management Review** *(pre-1986);* Fall 1973; 15, 1; ABI/INFORM Global

WISNER, A. **Por dentro do trabalho:** ergonomia, método e técnica. FTD; Oboré. São Paulo: 1987.

YIN, R. K. **Estudo de caso:** planejamento e métodos. Trad. Daniel Grassi. 2ed Bookman. Porto Alegre: 2001

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ERGONOMICS IN PREVENTION OF WORK ACCIDENTS: THE FORESTRY SECTOR CASE.

Abstract:

This paper is intended to identify the importance of changes in the working process in a sector of forestry on a company in the region of Santa Catarina. The research was qualitative and quantitative, the method of assessing the workstation met the ergonomics criteria, being analyzed, the demand for labor and labor activity, to this item, it was applied ergonomic check-list for the following evaluations: the condition of ergonomic method of work, the biomechanics occupational condition, the condition of ergonomic workstation, the condition of the degree of repetitiveness of the task, the activity waste energy via Lehman method and the analysis of the worker posture through the templates Couto and RULA. Among the resources used and of fundamental importance to ergonomics, the images through pictures, contributed to the analysis of data, in the anthropometrics evaluation it was used measure tape where average values were obtained in the sector of the population assessed, taking into consideration as a theoretical basis the German Standard called Deutsches Institut Für Normung (DIN 33,402), this standard provides points of reference in assessing the heights and lengths of work. The final results, after the Labor Ergonomics Analysis (AET) identified the ergonomic hazards and highlighted the improvements needed, thus avoiding accidents in Forestry, optimizing the labor work, helping to protect the employee and prioritizing the importance of ergonomic study in any job.

Key words: ergonomics, occupational accident, posture

ERGONOMIE DANS LA PRÉVENTION D'ACCIDENTS DE TRAVAIL : LE CAS DU SECTEUR MARCHAND DE BOIS

Résumé :

Le présent travail a l'objectif d'identifier l'importance du changement dans le processus de travail dans un secteur marchand de bois d'une société de la région de Santa Catarina. La recherche a été quali-quantitative, la méthode pour évaluer le poste de travail a respecté les critères de l'ergonomie, étant analysés, l'exigence de travail et l'activité ouvrière, pour cette question ont été appliquées un check-list ergonomique pour les évaluations suivantes: de la condition ergonomique de la méthode de travail, de la condition biomécanique professionnelle, de la condition ergonomique du poste de travail, de la condition du degré de repetition de la tâche, des dépenses énergétiques de l'activité à travers la méthode Lehman et de l'analyse de la position du travailleur à travers les modèles Couto et RULA. Parmi les ressources utilisées et de la fondamentale importance pour l'ergonomie, les images à travers des photos, a contribué à l'analyse des données, dans l'évaluation anthropométrique a été utilisées un ruban métrique où ont été obtenues des valeurs moyennes de la population du secteur évalué, en prennant compte comme base théorique la Norme Allemande appelée Deutsches Institut Für Normung (DIN 33402), cette norme détermine les points de référence dans l'évaluation de longueurs et hauteurs de travail. Les résultats finaux, après l'Analyse Ergonomique du Travail (AET) ont identifié les risques ergonomiques et ont indiqué les améliorations nécessaires, évitant ainsi les accidents dans ce secteur marchand de bois, optimisant la production ouvrière, contribuant à la prévention du travailleur et en donnant la priorité à l'importance de l'étude ergonomique dans quelconque activité ouvrière.

Mots clés : ergonomie, accident de travail, positions

ERGONOMÍA EN LA PREVENCIÓN DE ACCIDENTES DE TRABAJO: EL CASO DEL SECTOR MADERERO

Resumen:

El objetivo de este trabajo es identificar la importancia del cambio del proceso de trabajo en el sector maderero de una empresa de Santa Catarina. La investigación fue cualitativa y cuantitativa, el método para evaluar el puesto de trabajo respetó a los criterios de la ergonomía, siendo analizadas las demandas de trabajo y la actividad laboral, para esta cuestión fueran aplicados *check-list* ergonómicos a las seguientes evaluaciones: la condición ergonómica del método de trabajo, la condición en el grado de repetitividad de la tarea, gasto energético de la actividad a través del método Lehman y análisis de la postura del trabajador a través de los modelos Couto e RULA. De los recursos utilizados y de fundamental importancia para la ergonomía, imágenes de fotografías contribuyeron para el análisis de los datos, en la evaluación antropométrica fue utilizada una cinta métrica dónde se obtuvieron valores medios de la población del sector evaluado, teniendo como base la Norma Alemana nombrada *Deutsches Institut Für Normung* (DIN 33402), esta norma determina puntos de referencia en la evaluación de largos y altos de trabajo. Los resultados finales después del Análisis de Ergonomía de Trabajo (AET) identificaron los riesgos ergonómicos y destacaron las mejoras necesarias, evitando así los accidentes en el sector maderero, optimizando la produción laboral, contribuyendo para prevención del trabajador y enseñando la importancia del estudio ergonómico en cualquier actividad laboral.

Palabras claves: ergonomía, accidente de trabajo, posturas.

ERGONOMIA NA PREVENÇÃO DE ACIDENTES DO TRABALHO: O CASO DO SETOR MADEIREIRO

Resumo:

O presente trabalho tem o objetivo identificar a importância da mudança no processo de trabalho em um setor madeireiro de uma empresa da região de Santa Catarina. A pesquisa foi quali-quantitativa, o método para avaliar o posto de trabalho respeitou os critérios da ergonomia, sendo analisadas, a demanda de trabalho e a atividade laboral, para esse quesito foram aplicados check-list ergonômicos para as seguintes avaliações: da condição ergonômica do método de trabalho, da condição biomecânica ocupacional, da condição ergonômica do posto de trabalho, da condição do grau de repetitividade da tarefa, gasto energético da atividade através do método Lehman e análise da postura do trabalhador através dos modelos Couto e RULA. Dentre os recursos utilizados e de fundamental importância para a ergonomia, as imagens através de fotos, contribuiu para a análise dos dados, na avaliação antropométrica foi utilizada fita métrica onde foram obtidos valores médios da população do setor avaliado, levando em consideração como base teórica a Norma Alemã denominada Deutsches Institut Für Normung (DIN 33402), esta norma determina pontos de referência na avaliação de comprimentos e alturas de trabalho. Os resultados finais, após a Análise Ergonômica do Trabalho (AET) identificaram os riscos ergonômicos e apontaram as melhorias necessárias, evitando assim os acidentes nesse setor madeireiro, otimizando a produção laboral, contribuindo para a prevenção do trabalhador e priorizando a importância do estudo ergonômico em qualquer atividade laboral.

Palavras chave: ergonomia, acidente de trabalho, posturas