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Posture Assessment and Ergonomic Analysis of Pot Makers

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Ergonomics is the manipulation of a person's job about the environment, the tools and equipments, and the person in order to promote easier and safer job as well as productivity. This study specifically aimed to (1) assess the posture of pot makers while at work; (2) make a task analysis of pot making; (3) analyze their workstation; (4) determine possible existence of hazards in the workplace; (5) identify common work-related musculoskeletal disorders (WMSDs); and (6) determine if certain demographic factors are related to WMSDs. Descriptive-correlation design was utilized with regards the value of ergonomics among pot makers, particularly in Barangay Nagrebcan, San Nicolas, Ilocos Norte. Task analysis was divided into three phases: mixing, kneading, and molding. The study employed the Rapid Entire Body Assessment (REBA), Ovako Working Posture Analysis System (OWAS), Workplace Hazard Assessment, and the Discomfort Survey questionnaires. One representative sample of pottery maker was used in each phase to analyze the task, to assess the workstation, postures and the workplace. However, all the members were utilized for the discomfort survey. Task analysis showed that there were some constant awkward positions exhibited by the pot makers in doing their respective tasks: deep squatting and trunk bending. REBA showed that there were high risks of suffering of injuries while OWAS showed that several positions need corrective measures in the near future. Pot makers were accountable to some of the equipments used in the workstation that they do not exhibit correct postures and body mechanics. Presence of hazards was found: impact, dust, penetration, thermal, and rain. Low back and wrist/hands were the areas of the body where discomfort commonly occurred. This research is pertinent in providing awareness and this may serve as a basis for recommendation to improve productivity and welfare of employees among pottery industries in the Ilocos Region.

Keywords: ergonomics, posture assessment, pot maker, work-related musculoskeletal disorder

BACKGROUND

"Mold the pot, or else the pot will mold you!" Things that surround man must not control nor dictate his actions, his welfare lies in his own hands and into the four corners of his place. He should make plans in order for his place to fit him and him to fit the place. The success of his job depends on every little details of everything he sees in his workplace. No matter what the

job is, the goal is to make sure that he is safe, comfortable, and less prone to work-related injuries. Ergonomics looks at what kind of work a man do, the tools he uses and his whole job environment. The intention is to find the best fit between him and his job conditions [1].

San Nicolas in Ilocos Norte is well-known for its ancient art of terra cotta pottery. This has given a facelift with the revival of the lowly "banga" (cooking pot), which has become an icon of Ilocano heritage and traditional occupation that dates back to the turn of the 19th century. The Ilocos terra cotta manufacturing has been largely dismissed as a vanishing industry until the community began noticing the historical value of pottery as an enduring monument to the handmade craft that now symbolizes San Nicolas' heritage [2]. The area of pot makers in San Nicolas is an example of a workplace wherein workers develop their designs and manufacture their products for the market. In this kind of work, it is not uncommon that work-related musculoskeletal disorders (WMSDs) may develop among workers.

Despite the significant contributions of pot making industry in the culture and economic growth of San Nicolas and the rest of Ilocandia, there has been no conduct of an evidenced base study which addresses the needs and the problems that the workers are experiencing. Since pot making is generally an arduous task, its difficulty could be lessened if there is a good workplace. It is deemed necessary therefore that the status of the workplace be examined, hence, this study was undertaken. Generally, this study aimed to make posture assessment and ergonomic analysis among pot makers. Specifically, the study aimed to: assess the posture of pot makers while at work, make a task analysis of pot making, analyze the workstation, determine possible existence of hazards in the workplace, identify common WMSDs, and determine if certain demographic factors are related to WMSDs.

FRAMEWORK

Ergonomics is defined as the study of the individual in relation to his work environment [3]. It is the study of how a workplace and the equipment used can be best designed for comfort, safety, efficiency and productivity [4]. Its principles are used to improve the relation between the worker and the workplace. A practical approach to ergonomics considers the match between and among the person, the equipment he uses, the work processes and the work environment. This requires an understanding of human abilities and limitations imposed by the work environment, machines, tools and specific job tasks [5]. A person's capabilities, physical attributes and work habits must be recognized to improve ergonomic factors in the workplace [6].

This study assumes that due to the increasing demand of pots in the market workload will also increase. This scenario puts pressure on the working environment of the pot makers. Ideally, as workload increases, there should also be corresponding adjustments in the equipment, facilities and materials in the workplaces in order to cope with the increasing workload. However, due to economic deflation in most situations, adjustments do not happen. It is in this situation that work-related illnesses may arise.

Ambiguous description of posture and ergonomic factors conveyed interchangeable meanings. Thus, the researchers divided these in two categories: a) postural assessment and b) ergonomic analysis. Two different assessment approaches used but are similar in terms of predisposing WMSDs. Faulty posture and poor ergonomic setting can lead to the development of WMSDs. An ergonomic assessment is an all-or-none assessment composed of the task analysis, work station assessment and workplace evaluation. Each one of these should be put into consideration to produce an efficient result of assessment. The three factors of ergonomic assessment mentioned above are external causes of WMSDs. The socio-demographic factors of pot makers such as age, gender, hand dominance, length of service, mental and physical exhaustion correlates with the development of WMSDs.

METHODS

Design

In utilizing descriptive-correlation research design, the description of the pot maker's task, the posture at work, the work station and workplace assessments and the relationship between the demographic factors and development WMSDs were determined.

Subjects

The subjects of this study were the pot makers of one industrial site located at Barangay Nagrebcan, San Nicolas, Ilocos Norte. In accomplishing postural assessment for each phase of pot making, only one pot maker per phase was employed. However, all the workers were subjected as respondents for the discomfort survey to determine common WMSDs among pot makers.

Research Instruments

Task Analysis and Postural Assessment. Analysis of task was done by enumerating the components of each task required in pot making. Assessment of posture was done using the Rapid Entire Body Assessment (REBA) and the Ovako Working Posture Analysis System (OWAS).

The REBA, a postural analysis system that is sensitive to musculoskeletal risks in a variety of tasks [10], was specifically designed to assess various unpredictable working postures found in production workers, health care and other services. In addition, it is a front line assessment as part of a broader ergonomic assessment. In the sensitivity analysis of subjective ergonomic assessment tools, Escobar (2007) [11] found out that among the 15 tools evaluated, REBA is one between the two assessments that matched the selection criteria. All posture-based variables for REBA are sensitive as it is a user-friendly tool used for both static and dynamic postures that analyzes quantitative, subjective, self-reporting, potential and posture-based problems.

The OWAS, an assessment method of work postures for the back, arms, and legs, requires working postures to be observed, recorded, and

assessed [12]. The tool can be easily employed by simply observing and it required no interference with the pot makers' work. The first three digits of a six-digit code describe the position of the back, arms and legs, respectively. The fourth indicates the load or force exerted. The final two digits indicate the stage in the cycle/task. The information gathered is then compared to action categories, which determines whether some corrective action needs to be taken to reduce the risk of injury. In order to factor in the length of use, the action categories are evaluated against a table of values to determine the adequacy of the posture. Unacceptable postures are often those where the trunk is twisted or asymmetrically loaded. The OWAS classification consists of three sets of static body postures and one dynamic. These are four back postures, three arm postures, six leg postures, and "walking" respectively.

Workplace Assessment. The Occupational Safety and Health Administration (OSHA, 2006) [13] imposed that workplace hazard assessment should be done to identify the potential for violent incidents and to identify or confirm the need for improved security measures. In this study, it included conduct of follow-up inspections of the workplace and observations on hazardous work tasks to determine the presence of hazards, conditions, operations and situations which might place pot makers at risk of occupational offensive incidents. The workplace hazard assessment was used as an aid in performing hazard assessment within a workplace. Existence of hazards was determined by checking the listed hazard classification, possible hazards, their sources and the body parts that can be affected.

Work-related Musculoskeletal Disorder. The Industrial Accident Prevention Association (2007) [14] created a discomfort survey for WMSDs. This was utilized in this study to find out what discomforts, pain or disability the pot makers were experiencing which may be related to workplace activities. This was done by surveying and questioning pot makers about their health that causes WMSDs. Discomfort survey is a questionnaire tool in which all body parts are being assessed as to pain. Each respondent was asked to indicate how often they experience pain and in what particular body part through a scale of 0-10 (0 - being no pain and 10 - being severe pain).

Research Procedures

A request letter was forwarded to the owner of the pottery industry for the conduct of the undertaking. After the letter had been approved, the researchers had an actual observation for task analysis. Consequently, measurement of workstation of the pot makers was done. Thereafter, taking pictures were made for the posture of the pot makers while at work. Using REBA and OWAS, the researchers analyzed the three phases of pot making. For possible existence of hazards, the workplace was assessed which was made through an ocular inspection. The entire workplace was observed to note for the different hazards that may be present and that may lead to possible accidents. To identify common symptoms and incidence of WMSDs, a discomfort survey was conducted. A one-on-one interview was done to further expound on the contents of the discomfort questionnaire. Subsequent to the mentioned procedures, the data gathered were deduced and interpreted.

Statistical Treatment

Descriptive statistics was employed to explain the data gathered in the posture assessment and ergonomic analysis. As to each item in REBA, OWAS and Discomfort survey, mean ratings and percentages were utilized. Meanwhile, correlation coefficient Pearson R was also used to determine the identified factors of WMSDs.

RESULTS AND DISCUSSION

Task Analysis and Postural Assessment

The task analysis and posture assessment were made in three phases: phase 1 as the mixing process, phase 2 as kneading the clay, and phase 3 as molding the kneaded clay to pots. Good posture permits proper body mechanics. Correct posture conserves energy, reduces stress and strain to muscles, tendons, ligaments and soft tissues and this promotes efficient, effective and safe movement. It is important to assess the posture of pot makers because correct posture promote and maintain body control and balance which is a requirement for productive and safe pot making.

Phase 1 - Mixing. In the mixing process, there are four sub-tasks and all are performed in deep squat position (see Table 1). The pot maker produced 8 handful of mixed clay for every 10 minutes.

Table 1. Phase 1 – Mixing.

Job Title: Pot Maker
Work Task: Phase 1 - Mixing

A.

TASK ANALYSIS	MEASUREMENTS
1. Getting the hard soil.	Distance of the hard soil to the worker.
2. Crushing the hard soil with bare hands.	Force exerted to crush the soil.
3. Mixing the soil and water with bare hands on flat surface.	Force exerted to mix the soil and water. Distance of the water from the worker.
4. Mixing the sand unto it.	Force exerted and distance of the sand.

B. Postural Demands

Task 1-4 performed in deep squat position; may stand-stoop once in a while to get the other ingredients; requires constant flexion of the trunk and an alternate flexion and extension of the shoulder, elbow, wrist and fingers.

C. Task Rate

10 minutes for every 8 handful of mixed clay.

D. Working Hours

Usually 8 hours a day.

E. Environmental Conditions

1. Enough space area
2. Intermittent noise due to highway proximity.
3. Humid temperature

F. Training Requirements

No training required. Constant practice is needed.

Phase 1, Picture 1.

Phase 1, Picture 2.

Phase 1, Picture 3.

Phase 1, Picture 4.

Phase 1, Picture 5.

Table 2. Phase 1 – REBA.

Postures	REBA Score	Description
Phase 1 picture 1	9	High risk, investigate and implement change
Phase 1 picture 2	9	High risk, investigate and implement change
Phase 1 picture 3	10	High risk, investigate and implement change
Phase 1 picture 4	10	High risk, investigate and implement change
Phase 1 picture 5	10	High risk, investigate and implement change
Mean	8.8	High risk, investigate and implement change

The table 2 reveals that in phase 1, all four positions were at high risk with a mean REBA score of 8.8. It is necessary to investigate further the posture of the pot maker to determine if a faulty posture was exhibited. Thus, corrective measures should be implemented to correct the awkward postures which may aggravate the occurrence of WMSDs.

Table 3. Phase 1 – OWAS.

Postures	OWAS Score	Action Category
Phase 1 picture 1	3	corrective measures as soon as possible
Phase 1 picture 2	2	corrective measures in the near future
Phase 1 picture 3	1	no corrective measures
Phase 1 picture 4	3	corrective measures as soon as possible
Phase 1 picture 5	2	corrective measures in the near future

It shows in Table 3 that postures 1 and 4 needs an urgent corrective measures because such posture is highly susceptible to injury. Posture 2 and 5 needs corrective measures in the near future because no adverse effect is anticipated at present. Only posture 3 garnered a score of one which means that there is no corrective measure needed hence, it is a good posture.

Phase 2 - Kneading the Clay. In kneading the clay, there are five sub-tasks performed in deep squat position. The pot maker made 6 bunch of clay weighing 7 kilograms each for every 10 minutes (see Table 4).

Table 4. Phase 2 - Kneading the clay.
Job Title: Pot Maker
Work Task: Phase 2 – Kneading the Clay

A.

TASK ANALYSIS	MEASUREMENTS
1. Getting at least a bunch of a clay approximately 7 kilograms in weight.	Force exerted and the distance of the clay.
2. Kneading the clay 30 seconds on a flat surface.	Force of the worker to knead the clay.
3. Adding the sand	Distance of the sand
4. Kneading again for 30 seconds	Force exerted

B. Postural Demands

Task 1-4 performed in deep squat position; may stand-stoop once in a while to get the other ingredients; requires constant flexion of the trunk and an alternate flexion and extension of the shoulder, elbow, wrist and fingers.

C. Task Rate

10 minutes for every 6 bunch of clay weighing 7 kilograms each.

D. Working Hours

Usually 8 hours a day.

E. Environmental Conditions

1. Enough space area
2. Intermittent noise due to highway proximity
3. Humid temperature

F. Training Requirements

No training required. Constant practice is needed.

Phase 2, Picture 1.

Phase 2, Picture 2.

Phase 2, Picture 3.

Phase 2, Picture 4.

Table 5. Phase 2 – REBA.

Postures	REBA Score	Description
Phase 2 picture 1	9	High risk, investigate and implement change
Phase 2 picture 2	9	High risk, investigate and implement change
Phase 2 picture 3	10	High risk, investigate and implement change
Phase 2 picture 4	11	High risk, investigate and implement change
Mean	9.75	High risk, investigate and implement change

In phase 2, of the five positions analyzed, only one is described to be at medium risk while all the others were at high risk. The postures exhibited had a mean REBA score of 9.75 which means that an investigation and an implementation of changes should be done because the pot maker demonstrated simultaneous flexion and rotation of the trunk which may cause trauma leading to WMSDs.

Table 6. Phase 2 – OWAS.

Postures	OWAS Score	Action Category
Phase 2 picture 1	2	corrective measures in the near future
Phase 2 picture 2	2	corrective measures in the near future
Phase 2 picture 3	2	corrective measures in the near future
Phase 2 picture 4	2	corrective measures in the near future

Table 6 shows the posture analysis using the OWAS system. It was proven that the different postures in kneading the clay needs a corrective measure in the near future. Employer must change the setting of the workstation to avoid further harm to the body.

Phase 3 - Molding the Clay. There were 11 sub-tasks in molding the clay performed mostly in sitting position. The pot maker may stand thereafter once in a while to refill the ash bag and cut clay. This phase requires constant flexion of the shoulder and alternate flexion and extension of the elbow, hand, wrist and fingers. As a result, a pot maker makes 7 pots for every 10 minutes.

Table 7. Phase 3 – Molding.

Job Title: Pot Maker
Work Task: Phase 3 – Molding

A.

TASK ANALYSIS	MEASUREMENTS
1. Cut the clay into equal rectangular and flattened shape.	Force exerted.
2. Put an ash to the molder.	Height of the molder.
3. Get the cut clay and mold it to the molder.	Distance of the clay to the molder.
4. Fitting the clay into the molder.	Height of the molder.
5. Remove the excess.	Force exerted.
6. Get the other clay for the other half.	Distance of the clay to the molder.
7. Remove the excess.	Force exerted.

8. Get the excess clay to fill the other parts	Distance of the clay to the molder. Force exerted.
9. Get the other clay for the base of the pot.	Force exerted.
10. Fit and finish the pot.	Force exerted.
11. Remove the molded pot from the molder	Distance of the molder to the floor. Force exerted.

B. Postural Demands

Task 1-11 performed in sitting position, standing thereafter; may stand once in a while to refill the ash bag and cut clay; requires constant flexion of the shoulder and alternate flexion and extension of the elbow, hand, wrist and fingers.

C. Task Rate

10 minutes for every 7 pots.

D. Working Hours

Usually 8 hours a day.

E. Environmental Conditions

1. Enough space area
2. Intermittent noise due to highway proximity
3. Humid temperature

F. Training Requirements

No training required. Constant practice is needed.

Phase 3, Picture 1.

Phase 3, Picture 2.

Phase 3, Picture 3.

Phase 3, Picture 4.

Phase 3, Picture 5.

Table 8. Phase 3 – REBA.

Postures	REBA Score	Description
Phase 3 picture 1	5	Medium risk, further investigation, change soon
Phase 3 picture 2	7	Medium risk, further investigation, change soon
Phase 3 picture 3	8	High risk, investigate and implement change
Phase 3 picture 4	9	High risk, investigate and implement change
Phase 3 picture 5	9	High risk, investigate and implement change
Mean	7.6	Medium risk, further investigation, change soon

In Table 8, two were described to be medium risk and the rest are high risks. Postures scored 7.6, high risk, which signifies that the pot maker was susceptible to pain and may develop WMSDs in the near future. This should modify or implement changes in its position as soon as possible. In the case of medium risk score, it tells that a further investigation should be conducted.

Table 9. Phase 3 – OWAS.

Postures	OWAS Score	Action Category
Phase 3 picture 1	3	Corrective measures as soon as possible
Phase 3 picture 2	1	no corrective measures
Phase 3 picture 3	2	corrective measures in the near future
Phase 3 picture 4	1	no corrective measures
Phase 3 picture 5	2	corrective measures in the near future

Findings of Phase 3 was illustrated in Table 9 wherein one of the posture needs a corrective measure as soon as possible most especially the workstation set-up to prevent the occurrence of unbearable injuries which will lead to WMSDs. However, a corrective measure is needed in the near future in 2 postures demonstrated by the worker. Fortunately, other 2 postures seemed to be good because the pot maker exhibited proper alignment of body parts.

Workstation Analysis

In phase 1, the pot maker was 29 cm far from the clay and 70 cm to the sand. It means that the materials need in mixing was not within the reach. Pot maker must stand first to get the sand for mixing, which obliterates energy and adds stress and strain to the involved body muscles and underlying soft tissues.

The worker in phase 2 was 31 cm far from the clay and 60 cm to the sand. There is accountability to the equipments, however, inadequate body mechanics were observed in doing the task.

In phase 3, the distance between the molder to the ground in phase 2 was 21.2 cm and the chair to the ground is 33 cm. The distance between the pot maker to the clay was 26.5 cm proximally and 61 cm distally, pot maker to the ash was 34 cm proximally and 54 cm distally, and the chair to the molder was 18 cm. In an on-site observation, the pot makers are accountable to the equipments used in the workstation which implies that the worker somehow exhibited proper posture and body mechanics in doing the work. Thus, it reduces the risk of WMSDs.

Workplace Analysis

Table 10 shows the result of the workplace hazards. There are four hazards in the pottery industry that could affect some parts of the body. Other identified source was rain in which the pot makers may tend to slip off over their workplace that may cause to dislocating and falling injuries.

Table 10. Workplace Hazards in the Pottery Industry.

Hazard	Source	Body Parts Affected
Impact	Sanding, falling objects, propelled devices, flying particles	Head, face/eyes, body, foot, hand
Chemical	Ash, clay	Hands, skin
Dust	Ash, sand	Head, face, body
Penetration	Sharp objects, propelled devices,	Body and hands
Compression	None	
Electrical	None	
Thermal	Flame and extreme weather	Head, face/eyes, body, foot, hand
Light/ Nonionizing	None	

Impact hazards exist because of the presence of propelled devices that could make light things move or fly. Flying particles can affect any part of the body especially the eyes during the mixing phase which creates irritability to the employees. Since the molded pots have to be heat-treated, workers are exposed to extreme high temperature. Also, all exposed body parts were affected with thermal hazard due to too much exposure to sunlight when they placed the molded pots in the open field for drying prior to cooking. Other hazards identified to be present are dust and penetration hazards. Sharp and propelling objects if not avoided can possibly injure the body. Dust flying in the air could enter the eyes that may cause eye irritation. Hazards identified to be absent were compression, electrical, and light/non-ionizing hazards are found to be absent in the pottery industry.

Work-related Musculoskeletal Disorders and Demographic Factors

The demographic variables used in the study in determining factors for WMSDs were: age, gender, hand dominance, length of service, mental and physical exhaustion after work.

Age. Most of the pot makers (58.33%) belong to age range of 21 to 40 while 25% were 41 to 60 years old. On the other hand, 8.33% composed the age brackets of below 20 and above 61 years old.

Gender. 33% of the respondents were males, while 67% were females.

Hand Dominance. 75% of the pot makers were right-handed, 17% left-handed and 8% were ambidextrous.

Length of Service. 41% of the pot makers were working in the industry for more than 10 years because most of them live near the workplace and even some of them begun working as a pot maker since they were child or at their early adolescent. At present, they have been loyal to their work. Though, the pot makers experienced pain related to their work, they still continue to do their job because they have already adopted themselves to its nature. Meanwhile, 25% of the pot makers are employed for 3 months to 1 year and 1 to 5 years and 17 % for 5 to 10 years. None of them has worked in less than 3 months.

Mental Exhaustion after Work. In the distribution of respondents according to mental exhaustion, 67% of the pot makers were not worn out after their work and 33% of them confirmed occasionally. Mental exhaustion is the inability to think after a series of thinking. Pot makers do not experience this because their job does not entail them to do construct analysis in making a pot.

Physical Exhaustion after Work. 33% of the pot makers were often exhausted physically. A pot maker experience physical exhaustion when their body can no longer perform the daily tasks with maximum efficiency and often accompanied with pain.

Common Work-related Musculoskeletal Disorders

Based on the discomfort survey, the work-related body pains were identified together with other factors that may be related to the severity of pain experienced by the pot makers in the industry. There were 10 identified pot makers in the pottery industry of which 83% said they experienced discomfort related to work during the past year.

Table 11. Percentage of Pot Makers Experiencing WMSDs.

Area of Discomfort leading to WMSDs	No. of Pot Makers with WMSD	Percent of Pot Makers with WMSD, %
Neck	5	50
Elbows	2	20
Forearms	1	10
Wrists/ hands	8	80
Thigh	6	60
Ankle/feet	3	30
Shoulders	7	70
Upper Back	4	40
Lower Back	8	80
Hips	5	50
Knees	5	50
Lower legs	5	50

Table 11 shows the different parts of the body experiencing discomfort that could lead to WMSDs as well as the percentage of those who experienced it. Result of the survey showed that 80% of the pot makers experienced discomfort in the wrist/hands and lower back. This is expected because the above mentioned body areas exert forces the most. On the hands/wrist, small repetitive motions were done by them when kneading the clay or molding in which the hand was used to propel the molder. Furthermore, pot making requires a lot of trunk bending that may cause the pot makers to suffer low back pain. The WMSDs on the shoulders with 70% and the thigh with 60 % were also experienced by half of the pot makers. The least experienced discomfort was pain at the elbows and forearms, with 20% and 10%, respectively.

In an observation, pot makers usually performed their task in a faulty posture most of the time within their work hours. It was foreseen that due to their awkward posture, they would most likely to develop low back pain which is now the leading cause of disabilities among pot makers as well as with different industries. It was also proven that a discomfort to the hand/ wrist was very common among pot makers. This is frequent due to the

forceful kneading of clay. After that, a vigorous shifting of the clay due to great force or impact to the hand may lead to the occurrence of WMSDs.

Table12. Frequency of Work-related Musculoskeletal Disorder (WMSD)

Body Pain	Mean Rating	Description
Lower back pain	3.2	Often
Wrist/Hand pain	2.4	Occasional
Shoulder pain	2.4	Occasional
Neck pain	2.0	Occasional
Hip pain	2.0	Occasional
Thigh pain	2.0	Occasional
Knee pain	1.9	Occasional
Lower leg pain	1.8	Occasional
Upper back pain	1.6	Occasional
Ankles/Feet pain	1.5	Never
Elbow pain	1.2	Never
Forearm pain	1.2	Never

Frequency of Musculoskeletal Pain. Table 12 illustrates the result of the frequency of body pain experienced by the workers in the pottery industry. Lower back pain with a mean rating of 3.2 showed that there is the only body pain related to musculoskeletal disorder often experienced by the respondents. Lower back pain is commonly felt because it is one of the most commonly stressed body part in pot making beside the hand. In addition, it is close to the center of gravity (COG) thus great mass is being absorbed by the lower back which is aggravated by greater weight during work. It demands great effort of bending the trunk because of the nature of the work which is usually done in the ground. Another contribution is the absence of any furniture like table to lessen the effort of bending the trunk or a chair to provide support and comfort to their hips. Of the twelve WMSDs, eight were identified to be experienced occasionally by the respondents with a mean rating of 1.6-2.4 while three were identified to be seldom or never experienced with a mean rating of 1.2-1.5. The WMSDs identified to have been seldom or never experienced by many of the respondents were pain on the ankles/feet, elbows, and forearms. Lower back is the part of the body where pain is commonly felt because it is one of the commonly used body part in pot making beside the hand, it is close to the center of gravity (COG) so it is also implies that great mass is being absorbed by the lower back which is aggravated by greater weight during work.

Table 13. Degree of severity of the pain of musculoskeletal disorders.

Body Pain	Mean Degree of severity of pain	Description
Thighs	3.71	mild pain
Lower back	3.17	mild pain
Upper back	3.02	mild pain
Lower legs	2.80	negligible pain
Hips	2.76	negligible pain
Neck	2.68	negligible pain
Ankles/Feet	2.59	negligible pain
Shoulders	2.42	negligible pain
Knees	2.28	negligible pain
Wrists/Hands	2.22	negligible pain
Elbows	1.64	negligible pain
Forearms	0.90	negligible pain

Severity of Work-related Musculoskeletal Disorders. Table13 reveals the result of the severity of pain due to the musculoskeletal disorders as experienced by the respondents. It shows that the musculoskeletal disorder with the highest degree of pain is of the lower back. The pain of the thigh, lower back, and upper back were identified to have the highest severity of pain with a mean rating of 3.71 and 3.17 respectively. However, these mean rating is described as only mildly painful as experienced by the respondents. All the other musculoskeletal disorders given were seldom experienced by the respondents.

Factors Affecting Frequency of Musculoskeletal Disorders

The last specific objective is to determine if demographic factors such as age, gender, length of service, mental and physical exhaustion after work are related to the frequency of pain. To answer this, four null hypotheses were tested. Results are the following:

1. There is no significant relationship between length of time working in the pottery and frequency of pain due to musculoskeletal disorder.
2. There is no significant relationship between gender and frequency of pain due to musculoskeletal disorder.
3. There is no significant relationship between physical exhaustion and frequency of pain due to musculoskeletal disorder.
4. There is no significant relationship between mental exhaustion and frequency of pain due to musculoskeletal disorder experienced by the pot makers.

The mean frequency of the pain experienced by the respondents and the length of time that they had been working in the pottery were coded 1-5. Using Pearson R correlation coefficient, the computed r is 0.288. This correlation coefficient is relatively low. It shows that there is a very low correlation between length of time working and frequency of pain due to musculoskeletal disorders. This means that one could not predict that the longer one works in a pottery, the more frequent would be the suffering due to musculoskeletal disorders.

To determine if the correlation coefficient is significant or not, t-test was used. The computed value is 0.819 while the tabular value is 2.306 (df = 8, $\alpha = 0.05$). Therefore, it can be concluded that there is no significant relationship between length of service and frequency of pain due to musculoskeletal disorders.

The second hypothesis is that there is no significant relationship between genders of the pot makers to frequency of pain due to WMSDs. Based on the result, the Pearson r coefficient for the relationship of the two variables is 0.29. This correlation coefficient is relatively low. This means that there is very little relationship between gender and frequency of pain experienced by the respondents. To determine whether gender is significantly related to the frequency of pain due to musculoskeletal disorders, t-test was used. Result showed that the computed t is 0.897 while the tabular value is 2.306 (df = 8, $\alpha = 0.05$). Therefore, it can be concluded that there is no significant relationship between gender and frequency of pain due to musculoskeletal disorders. This means that one cannot predict whether one experience more frequently pain due to musculoskeletal disorders basing on one's gender.

The results in the data in determining the relationship between pain due to musculoskeletal disorder and physical exhaustion were as follows: result of the statistical analysis showed that the correlation coefficient between mean frequency of pain due to WMSDs and physical exhaustion is 0.03.

This correlation coefficient is very low. To determine if there is a significant relationship between these two variables, t-test was computed. The computed value of t is 0.08 while the tabular value is 2.306 (df = 8, $\alpha = 0.05$). Again, based on this statistical analysis, it can be concluded that there is no significant relationship between these two variables, musculoskeletal disorder and physical exhaustion.

For the last hypothesis, result of the statistical analysis showed that the correlation coefficient between mean frequency of pain due to WMSDs and physical exhaustion is 0.14. This correlation coefficient is very low. To determine if there is a significant relationship between these two variables, t-test was computed. The computed value of t is 0.857 while the tabular value is 2.306 (df = 8, $\alpha = 0.05$). Again, based on this statistical analysis, it can be concluded that there is no significant relationship between these two variables, musculoskeletal disorder and mental exhaustion.

Based on the result of this study, frequency of pain due to musculoskeletal disorder is not related to the following: gender, length of time working in the pottery, physical and mental exhaustion.

CONCLUSION AND IMPLICATIONS

Results showed that pot makers have the high risk of suffering from work-related musculoskeletal disorders (WMSDs). The study showed further that there is a high recommendation of changes in the near future in relation with their posture. There are some constant awkward positions noted in doing their respective task such as deep squatting and trunk bending which leads to WMSDs. Moreover, intermittent noise is also present due to its highway proximity. The pot makers are accountable to some of the equipments used in the workstation however they are not exhibit proper posture and body mechanics in doing their work. Presence of hazards was found and they are as follows: impact, dust, penetration, thermal and rain. Low back and wrist/ hands with the same percentage of 80% are the areas of the body where pain or discomfort commonly occurs which lead to WMSDs. The results were all obtained through postural and ergonomic tools, questionnaires and on-site observation.

There is a high risk for pot makers to suffer pain that leads to WMSDs at present and in the near future if the establishment administration will not implement correctional measures immediately. Faulty postures and poor ergonomics are the primary causes of WMSDs to pot makers. It also implies that complaints and/or common diseases encountered by pot makers are due to repetitive movements or abusive use of body parts.

The study findings have the following implications to practice: there is an imperative need for establishment administrators or owners to take corrective measures, provide use of safety devices and suits like masks when cooking the pot, remind workers with regard to the use of slippers to avoid injuries caused by penetration hazards, refurbishment of floorings to avoid slipping injuries during rainy seasons, use of working tables that suit the height of the pot makers to avoid trunk flexion and stooping, and provision of elevated roofing to protect the workers from extreme sunlight. The proponents of this study need to disseminate not only the pottery industries in San Nicolas but also the whole region on the possibilities of the presence of WMSDs to pot makers and provide education on the postures and body mechanics. This study may also be utilized as basis in adopting policies related to the pottery industries in San Nicolas and the whole region. Its need not ne underscored.

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