SAFETY AND HEALTH RISK MANAGEMENT IN SELECTED KENYA TEADEVELOPMENTAGENCYFACTORIES INBOMETCOUNTY,KENYA

ABSTRACT

Factoryworkersarefacedwithmyriadofoccupationalsafetyand healthrisksastheycarryontheir day to day duties in their workstations. These safety and health risks are as a result ofexposure to occupational hazards such as noise, organic dust, non-safeguarded or poorlysafeguarded machines, poor ergonomics, poor floor conditions and falls, hot surfaces, amongothers. The objective of this research was to establish the safety and health risk managementinKenyaTeaDevelopmentAgencyFactoriesinBometCounty.Thestudyusedcrossse ctionalanalytical research design that allowed data collection at one point in time and involvedphotography,interviews,observationandmeasurements(airqualityandnoise)fordatacoll ection.Theindependentvariableswereclassifiedunderindividualandsystemcharacteristics.Indivi dualcharacteristicswerethedemographicvariableswhilesystemcharacteristics were the hardware that make up a tea factory. The intervening variables werethe system that make up safety and health management system and administration in thefactory. The study was undertaken in Bomet County which has eight KTDA tea processingfactories.Thetargetpopulationwasemployeesin TeaFactoriesmanagedbyKTDA.Thes tudypopulation was 1019 workers in tea factories in Bomet County with a sample size of 317employees. Simple random sampling gave every worker a chance to be included in the study.The Yamane (1968) sample size determination formula was used in the study since the targetpopulationwaslessthan10,000people.AuthorizationwasobtainedfromKenyattaUniversity GraduateSchoolandethicalclearancesoughtfromKenyattaUniversity EthicalReviewCommittee while the research license was obtained from NACOSTI. Access to the KTDAFactories was granted by management through the managing director at the head office.Informed consent was sought from workers before participating in the study. Focus GroupDiscussionguide,intervieweradministeredquestionnaires,noisemeterandparticulatecount erwas used for data collection. Data was summarized using descriptive statistics such as mean,frequenciesandpercentages.Theinferentialstatistics;chisquareandbinarylogisticregression model was used to test association between variables. Qualitative data was grouped accordingtoemergingthemes.Datawaspresentedusingchartsandtables.Theprevalenceofoccupati onalhazardsinteafactorieswas41.3%.Thestudy statistically establishedthatmachinery without safeguards was the most prevalent occupational hazard at 40.5%. In thesampledfactoriesandspecificsections,KapkorosTeaFactoryandWitheringsectionsrecordedhi ghermeanequivalentnoiselevels(91.4dBAand97.3dBA)aboveexposurelimits(90.0dBA)stipulat edunderTheFactoriesandOtherPlacesofWork(NoisePreventionandControl)Rules,2005 while both $PM_{2.5}$and PM_{10} levels in sampled factories were below OEL and generallyhigh at the sorting section (0.34mg/m3 and 1.035 mg/m3) but within the exposure limitsspecified under The Factories and Other Places of Work (Hazardous Substances) Rules, 2007.Thestudyestablishedthatprovisionof PPEs,workplaceoccupationalaudits,risksassessments ,occupationaltrainingsandoccupationalexaminationofworkerswerethemitigationstrategiesempl oyedbythefactoriesinsafetyandhealthrisksmanagement.Levelofeducation(p=0.0001) and work experience (p=0.0001) were statistically significant socio-demographiccharacteristics and predicted safety and health risks management. The study recommends

theemployertoinstitutetestsontheefficiencyandadequacyofallsafetyriskmitigationstrategies.The study findings can be used for policy formulation and institutionalize changes whenmanagingOSH risks in Kenyan teaindustry.

Key words: Organic dust, Poor ergonomics, Disease, Health Risk

INTRODUCTION

Physical,chemical,biologicalagentsandunfavorableworkingenvironmentspredisposeworkers to a chain of occupational hazards and deleterious safety and health risks. Low- andmiddle-income countries (LMICs) and industrialized high-income countries are faced withserioussafetyandhealthrisksandwork-related injuriesanddiseases.There hasbeenadrasticdropinchemicallyrelateddisordersandoccupationalrelatedinjuriesbuthoweverarise inthecases of psychological hazards, disabilities and other vulnerable cases among workers inindustrialized nations that are high income while in countries with low-and middle-income(LMICs)exposureto occupationalhazards isstillcommon(Rantanen, 2017).

According to World Health Organization, there was reported 350,000 deaths due to fatalaccidents and 2000000 deaths due to work related diseases313m get non-fatal accidents(September 2021 WHO). It further reports that long working hours, workplace exposure toparticulate matter, asthmagens, carcinogens, ergonomic risk factors and exposure to noiselevelsaretherisk factorsto thediseasesand work-relatedaccidents.

A study in 2017on occupational hazards among tea factory workers of Bahawalnagar inPakistanillustratedthatworkerssufferedfromcoughandsneezing(25.4%),headaches(15.9%),tinnitus(15.9%)andheatcramps(4.8%)duetoexposuretothefollowingoccupationalhazards;organic dust,noiseandhightemperaturesrespectively.Thestudyfurtherasserts that workers were exposed to unguarded machines and machine parts, chemical andbiological agents. It was established from the study that there is a compensation mechanismfor workplace injuries but however, no major injury or fatal accident has ever occurred towarrantcompensation (Rafique *et al*, 2017)

In a generalized study on the factors contributing to occupational injuries among workers inmanufacturingsectorinAfrica,casualworkersandthoseworkerswhodonotreceivethe requisitesafetytraininghadhigheroddsinincurringworkplaceinjuries.Thisisbecausecasualworkersrarelybenefitinoccupationaltrainingsincemostoftheemployersregardthisascostlyaffairbecause of theiron andoffnatureof work.Thestudyaimedto identifythe contributingfactorsto occupational injuries at theregionallevel(Debela*et al,* 2022)

Kenyahasabout71professionalgovernmentoccupationalsafetyandhealthofficersandfacedwith an estimated 140, 000 workplaces. About 2.9% workplaces are annually inspected (ILO2013).Accordingtothe2019KenyaPopulationandHousingCensus,Kenyahas47.5Mpeoplewith 18 M being the working population both in formal and informal sector. Owing to thenumberofworkplaces,theDOSHSofficersareunableinspectallworkplacesinordertocheckthe implementation of the safety and health programs leaving a lot of workers exposed tooccupationalhazards.AccordingtoVision2030,Kenyaseekstoachievesustainabledevelopment in a clean and secure environment which is only achievable by having in place ahealthworkforce.

Tea growing in Kenya is classified as the largest employer in the private sector that employover eighty thousand workers in tea estates and about three million people depending directlyorindirectlyfortheirlivelihoods.Apartfromhorticultureandtourismsector,teacropasacash crop is one of the main country's foreign exchange earners. Black tea is a major producedgrade, however, green, yellow and white tea are produced according to the market order. Teais picked from the farms and delivered to the factory for processing. At the factories, the mainoperationisteaprocessingwithsectionssuchasproductionsections(floor),stores,workshops, weighbridges, plants and equipment such as air receivers and boilers, kitchen, quality controlroom,sanitaryconveniencesandadministrativeofficewherepotentialoccupationalsafetyan

dhealth(OSH)aspects andimpacts arefound(Kimeto, 2016).

Like in any other employment sector, programs on occupational safety of employees inworkplaces are developed. However, little or no implementation of these programs henceworkers in the tea factories are exposed to OSH risks in their daily routines. Non-safeguardedmovingpartsofmachines,chemicalexposure,exposuretobiologicalagentsandpoorworkingconditions like extremes of temperatures and poor hygiene are the main safety and healthhazardsin the teaprocessingsector(Dey*et al*., 2012).

Theworkerswillcontinuebeinginjuredifitheyarenotchecked,monitoredorsupervisedwhichin turn deprives the tea sector as well as the country of a healthy workforce which is animportant element for sustainable economic growth. The study therefore sought to determinethe extent of safety and health risk management in KTDA tea Factories within Bomet CountyinKenya.

Statementoftheproblem

Teamanufacturinginvolveswithering,cutting,fermentation,drying,sorting,packing,dispatch, routine machine maintenance and cleaning activities. In the process, workers areexposedtosafetyandhealthhazardswhichinclude;exposuretohighnoiselevelsfromsourcessuch as packing machines, vibro screens in the sorting sections and running vans of thewithering sections; exposure to inhalable and respirable tea dust at the drying, sorting andpacking sections; physical injuries such as cuts from non-safeguarded machines, exposure tovibrations from the packer machines, exposure to hot surfaces such as steam line system,electricalhazardsfromfaultyindustrialelectricalequipmentandinappropriateelectricalcabling; fire hazards, poor floor conditions, standing for long hours and repetitive workactivities. Manual Material Handling from wood billeting activities, boiler operations, loadingand offloading of trucks is also evident in these factories. Exposure to these occupationalhazards results in musculoskeletal injuries, respiratory defects, hearing impairments, fatigue,fatalandnon-fatalinjuries.In2019,WorkInjuryEvaluationClinicawardedanemployeeof

MogogosiekTeaFactoryCompanyLimitedinKonoinsub-countyofBometCountyacompensation of 1.5M. The employee was attending to broken down elevator conveyor whenanelectricalshockandasubsequentfallfromheightoccurred.Acasewhichwasalsoreportedto Directorate of Occupational Safety and Health Services. Additionally, according to Rotich(2020),exposuretonoise,ergonomicrisksandexposuretodustaremostprevalentoccupation al risks in KTDA tea factories in Bomet County. This necessitated the need todetermine safety and health risks management in order to close the gaps existing in safety andhealthrisk management system.

MATERIALSANDMETHODS

Research Design

The study used a cross sectional analytical research design to analyze safety and health risks management in selected KTDA Factories in Bomet County that also allowed collection of data at one point in time. It was an interactive analytical cross-sectional study that involved photography, interviewing and observation for data collection.

Target Population

The target population was the workers in KTDA managed Tea Factories in Kenya.

Study Population

The study population was workers in eight (8) KTDA managed tea factories in Bomet County undertaking tea processing activities which consisted of 1019 workers. The management of Kenya Tea Development Agency Limited confirmed the number of workers as the current population.

Sampling Techniques

All the eight KTDA tea factories were selected for the study as shown in table Table1-3. Every worker stood an equal opportunity of being included in the research which was achieved using simple random sampling technique. There were three categories of respondents; respondents in the factory floor (Leaf reception, Withering, CTC, Drying, Packing and Dispatch), respondents in auxiliary sections (Boiler, firewood billeting and storage section and workshops) and workers undertaking routine cleaning and maintenance activities. A full list of all workers in each category was obtained, respondents were then randomly picked from the list for interviews. Purposive sampling technique was applied in determining the sections to measure dust and noise levels.

Sample size determination

Since the target population is less than 10,000 people, the Yamane (1968) sample size determination formula was applied,

$$n = \frac{N}{1 + N(e^2)}$$

Where;

n=the desired sample size

N=The study population in the 8 KTDA tea factories in Bomet County which was 1019

e= the margin of error

Calculation;

$$n = \frac{1019}{1 + 1019(0.05^2)}$$

$$n = 288$$

Non response rate of 10% was added to get a sample size of 317

Sample size

The sample size consisted 317 employees in KTDA tea factories in Bomet County which was proportionately distributed to the number of workers in each of the eight (8) tea factories.

Data collection techniques

Both secondary and primary data was collected for this study. Secondary data was obtained from the factory. The primary data sources were the responses from the questionnaires, photographs taken and observation checklists. Data was collected through administration of questionnaires by trained research assistant. Before administration, the respondents were taken through the consent form and once they agreed, they consented by signing. Questionnaires were administered to respondents who met inclusion criteria. Four (4) Focus Group Discussions were conducted each consisting of 10 participants. Participants were taken through the discussions using FGD Guide. Each discussion took 40-60 minutes.

Data collection tools

The study used Noise Meter and Particulate Counter, structured questionnaires, observation

checklist, Focus Group Discussion guide and Workplace Risk Assessment and Control (WRAC) technique for data collection during the study.

Noise Meter

Noise levels sampling was done using a calibrated Cirrus Research Noise Meter serial number: G300618, CR: 162and Open Field Microphone serial number; 413564B.The sound level meter was calibrated by Kenya Bureau of Standards Laboratory Procedure MET/15/CP/02 on 22nd September 2022 and with calibration certificate number: BS/MET/19/15/3/10/02. Noise sampling was done at a height of 1.5 meters from the ground and 1-meter way from the source. The run time was averagely 15 minutes per sampling point with 9 points being sampled. According to Safe Work Australia Code of Practice on Managing Noise and Preventing Hearing Loss developed in 2018, noise level measurement should be taken over a period of time that will give representative of the noise produce when working or performing a task.

Noise level sampling was done at the processing and at the auxiliary sections and measured against Occupational Exposure Limits provided under The Factories and Other Places of Work (Noise Prevention and Control) Rules, Legal Notice number 25 of 2005. The unit of measurement was decibels (dBA).

Particulate Counter

Particulate Matter (dust) sampling was done using calibrated Osiris dust monitor serial number: TNO4400. The dust monitor has been calibrated and issued with calibration certificate number: 17216. The device is able to counter and measure airborne particles which include PM_{10}, $PM_{2.5}$ particles with a resolution of 0.1 $\mu g/m^3$. The dust monitor also measured the total suspended particles (TSP) and $PM_{1.0.}$ Individual particles drawn through the nephelometer are analyzed as they go through a laser beam then finally collected on a reference filter. Osiris dust monitor was set to 8 hours for every sampling point and done randomly in areas observed to have high levels of organic dust. Four tea factories were randomly selected for dust measurements.This was measured against Occupational Exposure Limits stipulated under The Factories and Other Places of Work Hazardous Substances Rules, Legal Notice No. 60 of 2007.

Structured Questionnaire

The study used interviewer administered questionnaire which was administered by trained field assistant. It was administered to workers in the eight KTDA tea factories in Bomet County. Every questionnaire was serialized for accountability and to increase chances of having them back. All the respondents were capable of answering question in English.

Observation Checklist

Observation checklist was used with photographs. A digital camera was used to take photos after consent was sought from the Factory Unit Managers. This was done in alignment to the objective of the study to capture and record the key areas and working conditions against safety and health risks. No personal identification or face recognition was captured in the photographs taken.

Workplace Risk Assessment and Control (WRAC) technique

Safety and health risk management assessment was done through an existing risk ranking technique by way of observation and interviews. Risk ranking model is a severity/probability model which take in place existing safeguards that limits the probability of hazard causing injury. The study adopted Workplace Risk Assessment and Control (WRAC) technique to

Identify and Analyze hazards. The occupational risk ranking model involved assigning numerical value of 1-5 (low to high) based on the control measures in place in minimizing the probability of hazard causing incident. Occupational risk rating is obtained by multiplying the Probability factor by the Severity factor (Risk Ranking = Probability x Severity)

Focus Group Discussion guide

The Focus Group Discussion Guide was also used. The guide was made, structured and aligned to specific objectives of the study. The focus group discussion was facilitated and moderated by the research assistant. Forty participants were randomly selected to participate in the discussions. Each Focus Group Discussion had 10 participants. All the discussions were streamlined according to the guide with each discussion taking utmost 60 minutes

RESULTS AND DISCUSSIONS

Prevalenceof occupationalhazardsattheFactories

Theoverallprevalenceofoccupationalhazardsatthefactorieswas41.3%with131respondentsexperiencinginjuriesinthelastoneyear.Unguardedmachinesandmachinepartswas the most prevalent (40.5%, n=53) occupational hazard in the factory. Repetitive task wasprevalentoccupationalhazardat14.5%,carryingheavyloadat13.7%,non-insulatedelectrical

conductorsat12.2%,hotsurfacesat6.9%,unprotectedworkatheightbeingprevalentat4.6%,slipperyfloorat3.8%,excessivenoiseandfallingobjectswereprevalentoccupationalhazardsin the tea factories at 2.3% and 1.5% respectively. From the focus group discussion, whenaskedaboutthemostprevalentoccupationalhazards,itemergedthatcutinjuriesandexposuretohigh levels of noisewerecommon safetyand health risks at thefactory.

*''We are often exposed to high levels of noise and open machine parts such like machinechains and sprockets. High noise levels is mostly from Withering and Driers area''- FDG 2***Table1: Prevalenceofoccupationalhazards**

Variables		**Haveyoubeeninjuredwhileat work(Yesn=131)**	
		Frequency	**Percentage%**
Causeof theinjury	Unguardedmachine	53	40.5%
	Repetitivetask	19	14.5%
	Carryingheavyload	18	13.7%
	Non-insulatedelectrical conductors	16	12.2%
	HotSurfaces	9	6.9%
	Unprotectedworkatheight	6	4.6%
	SlipperyFloor	5	3.8%
	Excessivenoise	3	2.3%
	Fallingobjects	2	1.5%

ExposuretoDustand Noiseatthe Factory

Dustandnoiseweremeasuredinthefactories.FouroutofeightteafactoriesunderKTDAregisterin Bomet Countywererandomlypicked for themeasurements.

DustExposureLevels

Measuring of dust was done to ascertain safety risk to particulate matter. The concentration ofPM_{10} (inhalable dust) and $PM_{2.5}$ (respirable dust) were measured and then subjected to theprovisionsunderHazardousSubstancesRules,LegalNoticeNo.60of2007andotherinternationalspecifications.Buccalanalysistodeterminetheconcentrationoftheinhaled

particles within the respiratory tract of the individual workers was not undertaken. The tablebelowillustrates occupational exposurelimits forboth respirableand inhalable dust. DustmeasurementwasdoneusingcalibratedOsirisAirmonitoringequipment.Theparticulatecounter was set at 8 hours interval and then mounted randomly in sections of the Factory andwithin the breathing zone (0.3m radius). The measured average of dust concentration at eachsectionwasthenrecordedasdisplayedonthescreenoftheparticulatecounter(Table2).Theparticlecounter's flowrate was5 liters per minute.

Dustlevelresults

Table 2. DustLevelParameters,(mg/m^3)

Units	**Mogogosiek Tea Factory (mg/m^3)**		**Kapkoros TeaFactory(mg/m^3)**		**Tirgaga TeaFactory(mg/m^3)**		**KobelTeaFactory(mg/m^3)**	
SampledPoints	**$PM_{2.5}$ (mg/m^3)**	**PM_{10} (mg/m^3)**	**$PM_{2.5}$ (mg/m^3)**	**PM_{10} (mg/m^3)**	**$PM_{2.5}$ (mg/m^3)**	**PM_{10} (mg/m^3)**	**$PM_{2.5}$ (mg/m^3)**	**PM_{10} (mg/m^3)**
Sorting	0.004	0.659	6.370	0.186	0.069	2.768	0.113	5.094
Drying	0.067	1.045	0.169	0.927	0.142	2.219	0.075	0.858
CTC	0.093	1.232	0.032	0.283	0.106	0.146	0.006	0.099
CFU	0.035	0.194	0.067	0.112	0.132	0.261	0.043	0.135
Packing	0.098	0.265	0.278	1.479	0.036	0.273	0.141	5.776
WoodBilleting	0.071	0.193	0.065	0.137	0.139	0.319	0.026	0.178
MeanDustLevelsineachFactory	**0.0613**	**0.598**	**1.164**	**0.521**	**0.104**	**0.997**	**0.067**	**2.023**

It was established that the sorting area of the factories has both high respirable and inhalabledust with recorded 1.6 $mg/m^3$and 2.2mg/m^3 respectively. CTC section recorded the lowestrespirabledustat0.1mg/m^3whileCFUrecordedthelowestinhalabledustat0.2mg/m^3.Among the groups, Kobel Tea Factory recorded highest PM_{10}at 2.023 mg/m^3 while Kapkoros TeaFactory recorded the lowest PM_{10}at 0.521 mg/m^3. Respirable dust ($PM_{2.5}$) were high inKapkoros Tea Factory (1.164 mg/m^3) while Mogogosiek Tea Factory recorded the lowest$PM_{2.5}$(0.0613mg/m^3).Fromthedustmeasurements,both$PM_{2.5}$andPM_{10}inthefactorieswere

within the daily exposure limits set out in The Factories and other Places of Work (HazardousSubstances) Rules of 2007. The levels were however above the East African Air QualitySpecifications,AmericanConferenceofGovernmentalIndustrialHygienists(ACGIH)guidelines andaboveWHOAir QualityGuidelines.

NoiseExposureLevels attheFactory

Industrialnoisewasmeasuredtodetermineexposuretonoiselevelsindifferentsectionsofthefactory. Duringthestudy,therandomlyselectedsectionsofthefactorieswerefullyoperational.Noisemeasurementwasdoneataheightof1.5metersfromthegroundand1meterawayfromthe façade of the noise source near the operator's consoles using a calibrated Cirrus NoiseMeter (Table 5). The setting was meant to reduce the impact residual sound from non-relevant sources of sound. The measured noise levels were compared to the OccupationalExposure Limits as outlined in the Factories and Other Places of Work (Noise Prevention andControl) Rules, 2005. The measured noise levels determine thepotential health risks toemployees in terms of Noise Induced Hearing Loss (NIHL). Noisemeasurement was done bymounting the noise meter and setting it into 15 minutes duration then recorded the results(Table 4). The 15-minute measurement interval allowed stabilization of the sound pressureandimproved the accuracy.

NoiseparametersinFactoriesand theirMean

Table 3. Noiseparametersof the factories,dBA												
Units	**MogogosiekTea Factory**			**KobelTea Factory**			**KapkorosTea Factory**			**TirgagaTeaFactory**		
Sampled Points	**Lmin**	**Lmax**	**Leq**	**Lmin**	**Lmax**	**Leq**	**Lmin**	**Lmax**	**Leq**	**Lmin**	**Lmax**	**Leq**
Withering	94.2	102.9	96.2	93.5	95.2	94.7	97.7	99.0	98.4	98.9	100.8	100.0
CTC	87.3	89.2	88.3	85.8	87.4	86.4	88.8	90.0	89.7	85.3	87.3	85.9
CFU	85.2	87.5	85.9	81.8	85.2	82.6	84.7	85.8	85.1	87.1	88.1	87.5
Drying	87.1	92.0	88.4	82.0	85.8	82.7	90.2	91.3	90.7	87.5	88.4	87.8
Sorting	86.3	91.3	87.3	85.7	89.1	86.8	88.3	90.6	89.5	84.5	86.3	85.0
Packing	82.1	94.5	84.5	81.9	93.4	91.7	86.8	97.1	92.2	86.3	90.4	88.5
Workshop	74.1	100.0	92.6	75.4	80.4	77.2	84.8	97.3	90.3	71.3	88.6	79.0
Boiler	74.2	85.1	77.1	73.3	82.0	80.9	82.9	83.3	83.1	81.5	87.4	82.2
Generator	99.6	101.1	100.4	100.1	100.9	100.5	102.1	103.9	103.5	88.4	104.1	101.6
Mean Noise Levels	**85.6**	**93.7**	**88.9**	**84.4**	**88.8**	**87.1**	**89.6**	**93.1**	**91.4**	**85.6**	**91.3**	**88.6**

Table 4. Dailynoiseexposuretime

WorkingSection	**Daily Working Time inhours**	**Resting (Tea/LunchBreaks) inhours**
Withering	6.5	1.5
CTC	6.5	1.5
CFU	6.5	1.5
Drying	6.5	1.5
Sorting	6.5	1.5
Packing	6.5	1.5
Workshop	6.5	1.5
Boiler	6.5	1.5
Generator	0.5	1.5
Mean	**5.8**	**1.5**

Equivalent continuous sound pressure level (Leq) in factories ranged from 80.8-101.5 dBA.The study ascertained that when theLeq,Lmaxand Lmin values in the factorieswereexamined, it was evident that the values and exposures in the factories are close. The dailyexposurelevelsrangedfrom85.3-97.3dBA.Thewitheringsectionrecordedthemeanequivalentcontinuoussoundpressurelevel(Leq)

as97.3dBAthehighestamongtheother

production sections. At the auxiliary sections, the generator room while running recorded thehighestwhiletheboilersectionrecordedthelowestequivalentcontinuoussoundpressurelevelat 101.5 dBA and 80.8dBA respectively. Among the factory units, Kapkoros Tea Factoryrecodedmeanequivalentnoiselevelsabove theOEL(91.4dBA)stipulatedunderTheFactoriesandOtherPlacesofWork(NoisePreventionand Control)Rules,2005.Thisisbecauseduringthestudy,mostofthemachineshadworn-outbushesthatneededmaintenance.Thenoiselevelsfor the other sampled Factories were below OEL provided under The Factories and OtherPlaces of Work (Noise Prevention and Control) Rules, 2005 except at the withering section.Audiometric results from secondary data illustrated normal audiometry. The tests have beendone by a designated health practitioner as required under Rule 4 (1) ofThe Factories andOtherPlaces of Work (Medical Examination) Rules, 2005

MitigationStrategiesforSafetyandHealthRisks

Occupationalmedicalexaminations,provisionofpersonalprotectiveequipment(PPEs),safetyand healthrisk assessments, internal safety inspections and industrialtrainings were thestrategies used by the factory to reduce safety and health risks exposure at workplace. Thestudyestablishedthat269(84.9%)respondentshadundergoneoccupationalmedicalexaminations and 317 (100%) had been provided with different types of personal protectiveequipment. Additionally, 317 (100%) of the participants indicated that safety and healthinspections are undertaken in their workstations while 317 (100%) indicated that the factoryundertakesinternal safetyinspections.

FactorsAssociatedwithManagementofSafety andHealthRisks

The management of safety and health risks at the factory was measured by the frequency ofoccupationalinjuriesandoccupationaldeathsattheworkplace.Chi-squarestatisticandbinary

logisticregressionanalysiswereusedtotesttheassociationbetweenworkexperienceandmanagementofinjuries at thefactory.

Table 5. FactorsAssociatedwithManagementofSafetyandHealthRisks

Variable	Category	Injuredatwork			Chi-square	PValue
		Yes	No	Total		
Age	25-29Years	48	44	92	6.169	0.187
	30-34Years	75	38	113		
	35-39Years	36	26	62		
	40-44Years	15	17	32		
	Above44 Years	12	6	18		
Gender	Male	124	96	220	1.482	0.224
	Female	62	35	97		
MaritalStatus	Single	75	56	131	2.897	0.235
	Married	103	74	177		
	Widowed	8	1	9		
Level of EducationCompleted	Non-formaleducation	6	7	13	21.462	**0.0001**
	Primaryschool	7	21	28		
	SecondarySchool	71	51	122		
	MiddleLevelCollege	86	51	137		
	Bachelor'sDegree	16	1	17		
WorkingStation	Workshop	24	20	44	36.397	**0.0001**
	GreenleafOffloading	5	18	23		
	FactoryFloor	71	43	114		
	Woodfuelsheds	21	16	37		
	Boiler	48	8	56		
	GeneralHousekeeping	48	8	56		
	Auto-garage	8	6	14		
WorkExperience	Lessthan 1year	1	6	7	33.739	**0.0001**
	1year	4	19	23		
	2-3 years	68	51	119		
	4-5 years	48	41	79		
	Over5years	64	15	79		

Chi-SquareTest

The study established that there was no significant relationship between age and managementofsafetyandhealthrisksatthefactory(p=0.187),therewasnosignificantrelationshipbetweengender and management of safety and health risks at the factory (p=0.224) and no significantassociation between marital status of the respondents and management of safety and healthrisks(p=0.235)as the*P*values weregreaterthan0.05.

Chi-Square analysis further found that the association between the respondent's level ofeducationandmanagementofsafetyandhealthriskswasstatisticallysignificantat(***p*=0.0001**),working station and management of safety and health risks being statistically significant at(***p*=0.0001**)andtheassociationbetweenworkexperienceandmanagementofsafetyandhealthrisks was statisticallysignificant at (***p*=0.0001**)asthe*P*values wereless than 0.05.

BivariateAnalysis

The level of education was significantly associated (***p*=0.001**) with the management of safetyand health risks with an odds ratio of 0.532 and a significant association (***p*=0.001**) betweenrespondent'sworkexperienceandmanagementofsafetyandhealthrisks withanoddsratioof 0.507.Theanalysisalsoestablishedthatthere wasnosignificantassociation(p=0.238)between respondent's workstation and management of safety and health risks at multivariate.Table 6.

BivariateAnalysis across demographic characteristics

Variable	**Injuredatwork**			
	OddsRatio	**ConfidenceIntervalat 95%**		**Pvalue**
		Lower	**Upper**	
Levelofeducation	0.532	0.390	0.725	**0.001**
WorkingStation	0.899	0.764	1.058	0.238
Workexperience	0.507	0.383	0.672	**0.001**

MultivariateAnalysis

Atmultivariateanalysis,thestudyalsoestablishedthatthelevelofeducationwassignificantlyassociated with the management of safety and health risks at the factory (**p=0.001**) with anadjustedoddratioof0.502.Managementofsafetyandhealthrisksatthefactorywassignificantlyassociatedwithworkexperienceat(**p=0.001**)withanadjustedoddratioof0.498.

Table 7. Associationat multivariateanalysis

Variable	**Injuredatwork**			
	AOR	**95%CI**		**Pvalue**
		Lower	**Upper**	
Levelofeducation	0.502	0.407	0.712	**0.001**
Workexperience	0.498	0.376	0.659	**0.001**

Key: AOR-AdjustedOddsRatio,CI-ConfidenceInterval

Note:*P*values werecalculated usingthe logisticregressionmodel.*P*is significantif<0.05.

CONCLUSION

The research concludes that the safety and health risks management at KTDA tea factories inBometCountywas fairand that;

5.3.1 Conclusiononeonspecificobjectiveone

Unguarded machinery and machine parts was the most prevalent occupational hazard in thefactory. Most of the Occupational injuries were as a result of exposed moving parts ofmachines.

5.3.2 Conclusion twoonspecificobjectivetwo

Based on the findings, it was established that routine occupational medical tests, provision ofpersonal protective gears, scheduled occupational risks assessments, safety inspections andindustrial trainings were the mitigation measures adopted by the factories to reduce safety andhealthrisks exposure.

5.3.3 Conclusion threeonspecificobjectivethree

Thelevelofeducationandworkexperiencearepredictorsofsafetyandhealthriskmanagementat thefactory.

5.4 Recommendations

Basedonthefindingsof this research,thefollowingrecommendationsaremade:

5.4.1 Recommendationoneonspecificobjectiveone

Havingnotedunguardedmachineandmachinepartsasthemostprevalentoccupationalhazardin the factory, it is recommended the factory management develop inventory of all machinesatthefactory.Themanagementshouldthencomeupwithascheduledonroutineintegrityan dfunctionality checks on the safeguards to minimize injuries. Monitoring and evaluation ofperformance of occupational trainings, safety health risk inspections and risks assessmentsshouldalso be done.

5.4.2 Recommendation twoonspecificobjectivetwo

Having highlighted provision of occupational medical tests, personal protective gears, safetyand health risk assessments and inspections and occupational trainings were the mitigationmeasuresemployedbythefactoriestoreducesafetyandhealthrisksexposure,themanage mentadvisedto evaluatetheeffectiveness of theseinterventions

5.4.3 Recommendation threeonspecificobjectivethree

Withtheresearchidentifyinglevelofeducationandworkexperienceaspredictorstothesafetyand health risks management at the factories, the research recommends that assignments ofduties and workstation at the factories should be done after a thorough job safety analysis hasbeen done and assignment given to workers based on their levels of education and workexperience

5.5 Recommendationsforfurtherresearch

- Theeffectivenessofthemitigationstrategiesonsafetyandhealthrisksin KTDAteafactories
- OccupationalSafetyand HealthRisksperceptionamongworkersinteamanufacturingfactoriesin Kenya
- Prevalenceofmusculoskeletaldisordersandassociatedriskfactorsamongworkersin KTDA tea factories

Ethical Approval:Authorization was obtained from Kenyatta University Graduate School and ethical clearance sought from Kenyatta University Ethical Review Committee while the research license was obtained from NACOSTI

Consent

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

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