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OCCUPATIONAL SAFETY AND HEALTH HAZARDS EXPOSURE AMONG FARM WORKERS AT AHERO IRRIGATION SCHEME, KENYA

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Abstract:-

Agriculture is one of the three most hazardous occupations in terms of safety and health due to,among others, the physical strain and repetitive movements associated with its tasks. This study was conducted to evaluate the exposure to occupational safety and health hazards among farm workers in Ahero irrigation schemes, Kenya. The findings will inform development of mitigation measures to support the government's goal of attaining food security. A sample of 38 farm workers were randomly selected across the scheme comprising of 7 villages. The data collected was sorted, edited coded and analyzed using SPSS ver. 20 and presented in descriptive statistics. Statistical tests for correlation was carried out using Pearson's correlation and the results presented using charts and tables. The study established that about 71% of the respondents were aged above 46 years. Most of the workers had attained a primary level education. Biological hazards were found to be more prevalent due to the presence of livestock, blood sucking pests and deficiency of clean drinking water in the farms and poor sanitation. Majority of the farm workers lifted heavy weights with over 40% of the farm workers lifting 86 Kgs and above. There was widespread use of agrochemicals that included organophosphates (31.6%) without adequate protection in a very hot environment. The study concludes that farm workers at Ahero irrigation scheme are exposed to myriads of occupational hazards which can be an impediment to food security and achievements of the government's vision 2030.

Keywords: - *Farm workers, Irrigation scheme, Occupational safety and health, occupational hazards*.

Agriculture is the second greatest sources of employment worldwide after services accounting for more than one third of global employment (International Labour Organization [ILO], 2010). Agriculture, together with mining and construction, is one of the three most hazardous sectors in the world in terms of safety and health. The physical strain and repetitive movements associated with many agricultural tasks can deform bones and injure ligaments and muscles especially in the back causing life-long disabilities. The increased use of agricultural chemicals and motorised agricultural machinery by farmers in developing countries has resulted in increased rates of injury and poisoning among workers (ILO, 2012). Dust, spores, pollen, poisonous substances and gases developed during the process of farming could induce respiratory diseases (Lee & Lim, 2008). It has also been reported that individuals working in agriculture and animal husbandry are more predisposed to developing occupational diseases such as asthma and respiratory ailments caused by dust, chemicals and allergens (Cakmur, 2014).

The Ahero Irrigation Scheme is located in the Kano plains between Nandi Escarpment and Nyabondo Plateau within Muhoroni Sub County of Kisumu County (figure 1).The scheme was started as a pilot project to explore the feasibility of irrigation in the Kano Plains. Construction of the scheme started in 1966 and operations started in 1969 (National Irrigation Board [NIB], 2017). The main crop grown at Ahero irrigation scheme is rice. Other crops include Soybeans (seed and commercial), watermelon, maize, tomatoes, sorghum and cowpeas. In the year 2014, Ahero irrigation scheme had 946 plot holders cultivating 1,215 hectares of land that yielded 8,326 tons of rice (Kenya National Bureau of Statistics [KNBS], 2014).

Ahero, like other public irrigation schemes in Kenya, is managed by the National Irrigation Board (NIB). The board was established and incorporated in 1966 as a state corporation through the Irrigation Act, Cap 347 of the laws of Kenya. Among the mandates of the board are:- Coordination of construction and rehabilitation of major irrigation and drainage infrastructure; operation and maintenance of major irrigation and drainage infrastructure; administering land in the public schemes and providing technical advice to farmers. NIB undertakes the development, operation and maintenance of irrigation infrastructure through which it conveys irrigation water to the crop land.

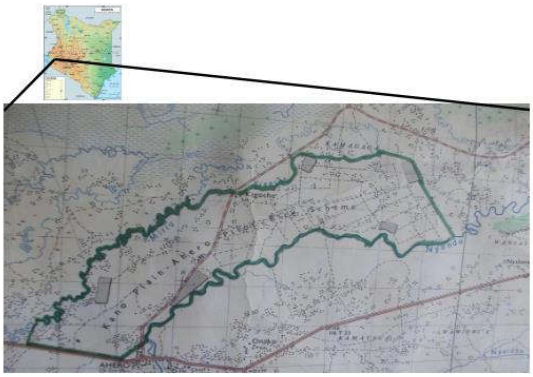

Fig 1: Locational map of Ahero irrigation scheme. Source NIB.

The objective of this study was to evaluate the occupational safety and health hazards farm workers are exposed to atAheroirrigation scheme. Previous studies in different parts of the world, among them Ireland, Korea, Ghana, Nigeria, Kenya, Ethiopia and Turkey have shown that farm workers were exposed to various occupational hazards (Litchfield, 1999; Mburu, 2006; Finnegan, 2007; Lee & Lim, 2008; Muilerman, 2013; Okereke & Okereke, 2015; Karunamoorthi,., Mohammed,., & Wessie, . 2012; Cakmur, 2014)

METHODS.

The research adopted a descriptive research design that applied a triangulation strategy to converge both quantitative and qualitative data to provide a comprehensive analysis. The research team obtained a letter of introduction to the irrigation scheme management from the Jomo Kenyatta University of Agriculture and Technology (JKUAT), Kenya. The data collection phase began with a visit to the headquarters of the National Irrigation Board (NIB) offices in Nairobi. At the office the research team was introduced to the NIB scheme manager in charge of Ahero irrigation scheme who then linked up the team with the local Irrigation Water Users Association (IWUA). The local IWUA officials introduced the farm workers to the research team.

The sample size for data collection was calculated using Israel, 1992, revised 2009 and reviewed 2012 from a population of 946 plot holders (as part of a larger study that incorporated other irrigation schemes). A total of 38 respondents were selected using simple random sampling to be part of the research. All plot holders in the scheme who were present on their farms during the data collection time qualified to be respondents. The household head for each plot was taken to be the farm worker for the purpose of this study. Ahero irrigation scheme was clustered into seven villages and to ensure a representative sampling framework, the respondents were proportionately allocated in each village.

Two methods of data collection were employed –structured interview and field observation. In the structured interview, the farm workers were interviewed face to face by the researcher or his research assistants. At times it became necessary for the interview questions to be interpreted verbally to Kiswahili for purposes of respondents who were not proficient in English. Ethical approval was sought and granted by Kenyatta University ethics review committee before commencement of the research process. The researchers explained the objectives of the research and the rights and

obligations of the participants to the sampled individuals. Thus, all the participants gave informed consent orally. The participants were not required to give their names and hence whatever answers they gave remained anonymous. The information given was not shared with other participants and therefore remained confidential. The study included field observation by the researcher to examine the type of hazards present in each production stage of the crop. A hazard checklist that addressed all stages of farm work from land preparation to harvesting was used. This meant regular visits to the farms at intervals. Photographs were taken as evidence of the identified hazards. The data collected was sorted, edited, coded and analyzed using the statistical package for the social sciences (SPSS) version 20 and Excel 2013. The results have been presented in charts and tables.

RESULTS AND DISCUSSION

All the 38 interviews were successfully carried out giving a 100% return rate. This excellent achievement may be attributed to the sensitization that was carried out by the IWUA to their members and the personal presence of the researcher throughout the data collection period in the irrigation scheme. The respondents comprised of 60.5% males and 39.5% females. About 71% of the respondents were aged 46 years and above as can be seen in table 1 below while 89.9% had attained primary school and above and 77.3% had above 10 years' experience in farm work. These results indicate that the farm workers are capable of receiving instruction and giving accurate answers.

Table 1 Demographic characteristics of the respondents

VARIABLE		AHERO %
Gender	Male	60.5
	FEMALE	39.5
Age (years)	< 20	0
	21 – 35	7.9
	36 – 45	21.1
	46 – 60	60.5
	➢ 60	10.5
Education	None	10.5
	PRIMARY	39.5
	SECONDARY	36.8
	TERTIARY	13.2
	UNIVERSITY	0
Experience (years)	< 5	10.5
	5 – 10	13.2
	11 – 19	36.8
	20 - 30	21.1
	➢ 30	18.4

WORKPLACE OCCUATIONAL HAZARDS

Irrigation farm workers at Aherowere exposed to a number of occupational hazards which were classified in their broad categories as chemical, biological, physical and ergonomic hazards. Biological and ergonomic hazard exposures were more prominent at the scheme at 28.79% and 26.31% respectively. Physical hazard exposure was at 23.95% while chemical exposure was at 20.94% as shown in the figure 2 below

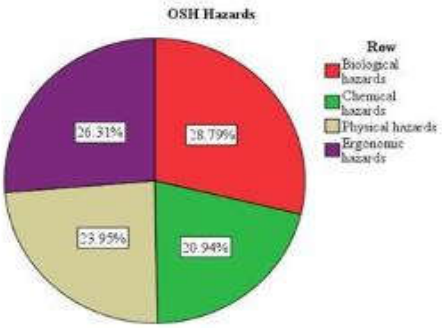

Fig 2: Self-reported OSH hazards exposure levels at Ahero irrigation scheme

Biological hazards

Biological hazards in the farms arise when farm workers get exposed to fungi/moulds, insect bites, animal waste, bacteria and virus. When asked to indicate whether they were likely to be bitten by animals/insects, 89.5% reported in the affirmative while 10.5% reported that they were unlikely to be bitten. 55.9% of the respondents reported that they were likely to be bitten by mosquitoes, 88.2% by leech, 35.3% by snakes and 26.5% by different types of flies as shown in table 3 below. Further investigation into how many have ever been bitten by a snake, only 10.5% reported positively.

Table 3: Insects/animals likely to bite farm workers at A hero

ANIMALS/INSECT BITES	%
Mosquitoes	55.9%
Leech	88.2%
Snakes	35.3%
Flies	26.5%

About 54.1% of the respondents kept livestock. Farm workers reared livestock for purposes of manure, milk, meat and as a means of transportation by pulling carts. The livestock included cows, goats and donkeys. The presence of livestock presents biological hazards through parasites, faecal contamination, and undercooked animal related food (Boischio, Clegg, & Mwagore, 2006; Langley, Rick, Morrow & Morgan, 2010). Exposure to toxic gases from decomposition of animal waste and exposure to animal allergens may cause adverse health effects in addition to the development of numerous zoonotic infections.

Clean drinking water was not readily available within Aheroscheme farms. Farm workers were dependent upon raw irrigation canal water for drinking while at work. Observations also revealed that there was lack of toilets/latrines on the farms or the surroundings. This is, despite the fact that the farm workers work long hours in the farms during harvesting and also rice drying period. Consequently, contamination of canal water through defecation and other calls of nature was inevitable. The nature of the scheme was however not conducive to construction of latrinesdue to the nature of the marshy land (plate 1).

Plate 1: There was no latrine/toilet facility in this expansive area of the farms

Ergonomic hazards

The respondents were asked to state if they lift heavy objects in the course of their work. 71.1% reported that they lift heavy objects while 28.9% reported that they don't. When requested to state what they considered as heavy objects, 31.6% cited manure and fertilizer while 28.9% cited farm produce. Other heavy objects lifted included planting seeds by 21.1%, farm tools by 7.9% and weed at 2.6%. The approximate weights lifted were as shown in figure 3 below. In the figure, 33.3% of the respondents lifted between 46 –55 Kgs. This was the weight of a bag of fertilizer and also a bag of farm manure. The weightsof between 86 –95 Kgs was the standard weight of harvested rice for sale at the NIB stores while weights above 95 Kgs were primarily the weights of harvested rice after drying as shown in plate 2and lifted by over 40% of the respondents. The bag inthe plate 2 was weighed and found to be 110 Kgs. There are no prescribed standards on maximum weights that can be lifted by both men and women in Kenya, UK or even USA but the National Institute of Occupational Safety and Health (NIOSH) of USA has developed a formula that should be used by employers while carrying out a lifting risk assessment (Centre for Disease Control [CDC], 2018; Health Safety Executive [HSE], 2018).

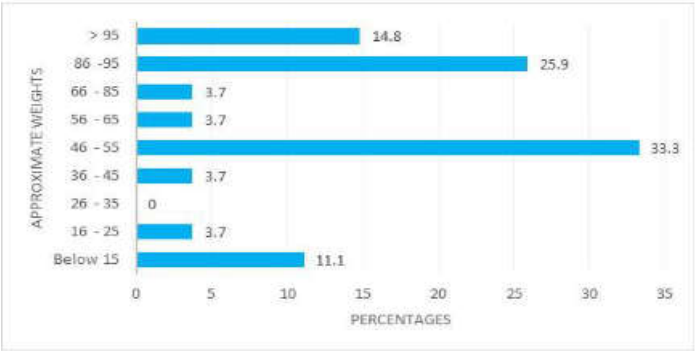

Fig 3: Approximate weights lifted by farm workers in A hero

Plate 2: Lifting heavy loads in Ahero

From the observations of the researcher most of the agricultural work was noted to be of repetitive nature with awkward posture that was likely to present ergonomic issues leading to musculoskeletal disorders. Manual land preparation work using jembes (hoes), planting rice, weeding in rice fields, clearing of the canals and harvesting were all repetitive works with awkward postures. Workers had to use a lot of force in using tools and lifting to get the job well done inalmost all the work they do.It was noted that some farm workers were using simple machines to move heavy loads but others preferred carrying them on the shoulders "since it was faster".

When the respondents were asked if they feel persistent pain in any part of the body, 92.1% reported positively with 77.1% among them reporting back pain, 62.9 % lower back, 51.4% shoulder, 51.4% hand, 45.7% arm, 37.1 % legs and 28.6% neck pain as shown in figure 4.

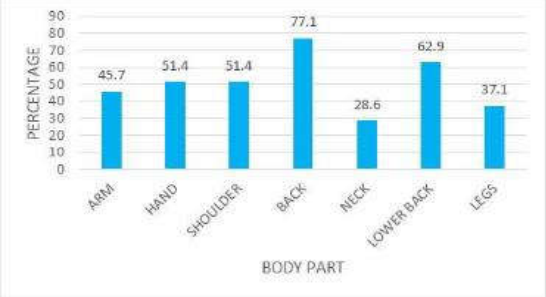

Fig 4: Body parts that pain persistently

The back and lower back pains had the highest incident rates as shown in the figure 4. All the above were signs of poor ergonomics while at work and lifting of heavy loads. Lifting of heavy loads is one of the three risk factors that are of utmost priority in agriculture according to Fathallah, (2010). Yonelia and Kurniawidjaja, (2013) and Muilerman, (2013) have also reported ergonomics as among the key risks in Indonesia and Ghana respectively. There was however no significant correlation between lifting of heavy loads with back and lower back pains ($r=0.071$, $p=0.684$, $N=35$) and ($r=0.116$, $p=0.505$, $N=35$) respectively in this study These results shows that lifting weights was not the only risk factor responsible for back and lower back since there were other work practices that could produce the same results.

Physical hazards

Irrigation farm workers at A hero were exposed to several types of physical hazards. 94.7% of the respondents reported that their work involved working in a wet environment and a similar number were exposed to a hot environment. In both cases 5.3% of the respondents reported negatively. Observations by the researcher revealed that the landscape was flat and plain with no trees to provide shade and some elements of work involved working inside muddy and wet surfaces (see Plate 3 and 4). Analysis of the exposure to physical hazards showed that nearly all the farm workers were in agreement that they were exposed to hot weather in a wet working environment throughout the season. . Farm workers in the irrigation scheme work for about six hours a day from 7.a.m to past 5 p.m. with their feet and the hands immersed in water (see plate 4). Wet work is defined as activities where workers have to immerse hands and/or feet in a liquid for a period greater than 2 hours in a working day and has been reported to be a cause for occupational dermatitis (Behroozy & keegel, 2014) Working in conditions that are too hot can also cause heat stress and can affect a person's ability to work, potentially leading to heat exhaustion, dehydration and heat stroke.

Plate 3: Makeshift heat protectors

Plate 4: Farm workers planting rice in Ahero

The operation of machinery and tools presented serious safety hazards to the farm workers. When asked whether they used machinery, 92.1% of the respondents responded positively with 82.9% reporting that they used tractors, 22.9% used ploughs. 39.5% of the respondents reported that they used hand carts driven by bulls or donkeys. The researcher made an observation that the tractors were owned and operated by third parties and therefore farm workers did not have direct contact with them. However, ploughs were owned and operated by the farm workers themselves.

Tools were used inthe whole crop cycle in the irrigation scheme as observed during the data collection period. There were tools for land preparation, tools for planting, tools for weeding and tools for harvesting. The most popular tools were the hoe (jembe) and the machete (panga). The jembe was used during land preparation, planting and weeding while the panga fitted in all the above activities. When asked about the type of tools they used, 89.5% reported that they used the jembe, 78.4% reported they used the panga, 16.2% used the sickle, 43.2% used a rake while only 5.4% used a spade. The sickle is used for harvesting rice, however its reported usage was low perhaps due to the panga being used as an alternative for the same purpose. Tools and machines have been reported in other studies as key hazards in agriculture, (Litchfield, 1999 Kuye, Donham, & Marquez, (2006).; Lee & Lim, 2008; Pullock, 2010 and Muilerman,2013)

Chemical hazards

Farm workers were at risk of chemical hazards arising from spraying of agrochemicals and handling of fertilizers. When asked whether they spray agrochemicals, 97.4% of the respondents, reported in the affirmative. The agrochemicals were classified in three distinct groups of pesticides, herbicides and fungicides. In Ahero pesticides and fungicides were widely in use compared to herbicides. Tata Umeme and Colt were the most popular pesticides with the usage at 39.5% for Tata Umeme and 31.6% for Colt. Other pesticides in use included Titan at 10.5%, Robust at 7.9%, and Duduthrin at 2.6%. Another 2.6% of the respondents reported that they used pesticides but they could not remember their names while 5.3% did not know whether they used pesticides or other agrochemicals. Figure 5 summarizes the reported usage of different pesticides.

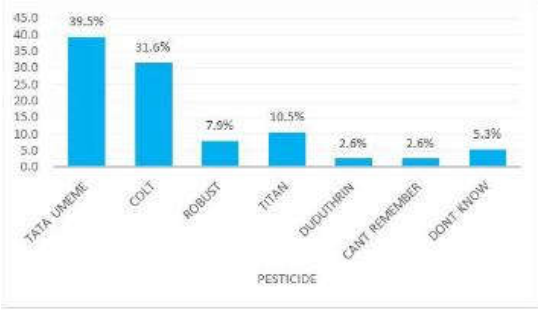

Figure 5: Pesticides in use at Ahero

Tata Umeme and Colt were both registered by the Pest Control Products Board (PCPB) in Kenya as insecticides (PCPB, 2016). The active ingredients for these insecticides are Lambda –Cyahalothrin for Tata Umeme, and Chlorpyrifos for Colt. The information available from the material safety data sheets (msds) indicates that Chlorpyrifos is an organophosphate. It affects the nervous system of people with the effect lasting for days or even weeks. Exposure to small amounts may cause running nose, tears, increased saliva, sweating, headache, nausea and dizziness while serious exposures can cause vomiting, abdominal muscle clamps, tremors, body weakness and loss of coordination. Severe exposures may lead to unconsciousness, loss of bladder control and difficulty in breathing (Christensen, Harper, Luukinen, Buhl, & Stone, 2010). Lambda-Cyahalothrin belongs to a group of chemicals called pyrethroidswhich are manmade chemicals that are similar to the natural insecticides pyrethrins. It may cause irritation to the skin, throat, nose, and other body parts if exposed. Other symptoms may include dizziness, headache, nausea, lack of appetite, and fatigue (NPIC, 2001).

The fungicides that were widely used by the respondents in Ahero were Zyban and Pearl at 31.6% and 23.7% respectively. Surprisingly, 21.1% of the respondents used fungicides but could not remember them by name. Other fungicides in use included Topsin and Sulcop at 5.3% each and Mistress at 2.6%as indicated in figure 6.

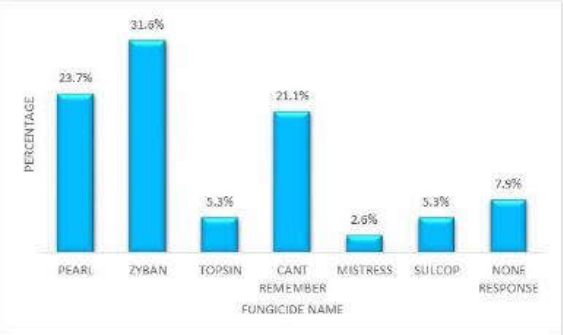

Figure 6: Fungicides in use at Ahero irrigation scheme

Herbicides usage in Ahero was very limited. The herbicide in use was Agrimine at 15.8% followed by roundup and Platform Turbo at 5.3% each and Sanaphen at 2.6%. However 5.3% of the respondents could not remember the herbicides by name though they used them.Chemical hazards were also present in the farms due to a dusty working environment. When asked whether their work involved working in a dusty environment, 97.4 of the respondents agreed that their work environment was indeed dusty. The types of dust they were exposed to included soil dust reported by 71.1%, pollen dust by 31.6%, manure dust by 10.5%, rice husks dust 36.8% and chemical dust at 5.3%.

Observations showed that the application of chemicals was not being considered as hazardous by the majority of the farm workers. There were no personal protective equipment in use and majority sprayed while wearing folded trousers, no shoes and in some cases without shirts thus exposing the skin to contaminants. Chemical exposure was observed to be throughout the crop cycle starting from herbicides to clear weeds during land preparation, handling treated seeds during planting, fertilizers and fungicides during transplanting and insecticides during maturity.

CONCLUSION

The study concludes that farm workers at Ahero irrigation scheme were exposed to myriads of occupational hazards with biological hazards leading, closely followed by physical hazards. The presence of stagnant irrigation water at the workplace and rearing of livestock presents parasitic challenges to the farm workers. The study recommends farm workers education and training on occupational safety and health hazard identification and control.

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