Developing Ergonomics on Hot Double Plate/Stove

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ABSTRACT

Hot double plate/ stove is an integrated electrical heating device which used to cook, bake and stew. Also electric stove may be controlled by a rotary switch. Most people uses this electric stove, especially peoples those living in urban area. Those stoves used for cooking and others are for preparing stew, therefore different types of stove are there. But At this research it consider on electric stove which used for stew or the other name of this stove is hot double plate of electric stove. Major number of the populations of Ethiopia those living in urban (city) uses this hot double plate for prepare stew, There are some ergonomically problems on that stove. This stove hasn't foot; it is directly put on the land (ground) and use it. On the other hand there is no distance/height or space between the land (ground) and the stove. Users do their job always fully stretching to down ward, but the body and age of all peoples are not the same so it's difficult to stretch beyond of his ability during doing their jobs.

Not only this but also, the back body of the user of the stove is concave to downward during uses. The duration of using that stove is at least three times per day, so this problem it affect the peoples those uses hot double plate. After a long period of time the output of this problem is back pain and knee pain happened on the peoples.

This research wants to develop ergonomics on the hot double pale in order to solve exist of the problems. This problems solved through ergonomic system make/ design the foot in both direction for exist stove, in order to make space in some height between the ground to the stove for easily appropriate for use. When it design the foot of the stove by using solid work software and considering the body of the user with height of stove foot. Then after it making of the foot on the stove in both directions, the exits problem get a solution and also the users satisfying with easily use that stove during doing their job with reduced of back pain and knee pain.

Keywords: Ergonomics; Hot double plate; Anthropometric; Health

INTRODUCTION

The development of technology for new product set it needs to find a solution and create wellbeing condition for human on their life and also considering and performing on a job will result less fatigue and energy loss [1]. Hot plate/stove is used for cooking in daily life activities of the peoples but, ergonomically principles are not frequently considered in design of the kitchen materials (stove) and other tools in developing countries [2]. Food preparation activities in the kitchen it may experience fatigue and discomfort when performing highly repetitive task for a long period of time and it continued work under these difficult conditions may result in chronic injuries to muscles with back and knee pain with injuries of these types are known as Work Related Musculoskeletal Disorder (WRMSDs) and it does occur when the physical capabilities of the workers do no match the physical requirements of the job and also musculoskeletal disorder like back and knee pain and other parts of the body pain can happen to anyone who perform activities in the kitchen [3,4], One of the significant health problem faced by human while working in a kitchen is pain perceived extremely at lower and upper back region and work had an excessive influence on the evolution of the Musculoskeletal Disorder (MSD) among women involved in various kitchen activities [2,5]. If the workers/users continuously perform the activity during food preparation in the kitchen, they may experience prolonged it creates fatigue and others problems because of uncomfortable working conditions and improper designing kitchen materials like stove and it spent time by the users/workers is 6 to 8 hours per a day and there is a repetitive movement with task which causes of back and knee pain on the users of that materials like stove because of the physical capabilities of the workers do no match the physical requirements of the stove [3,6,7]. Improper designing of hot plate/stove in kitchen are causes of ergonomic problems and it can make uncomfortable working work generally involving tasks are pushing, pilling lifting and carrying materials those causes of injuries and it also often designed without considering the people who will be using them [8]. Ergonomics has a great role on product development process with improvement in order to reduce ergonomically problem [9]. Well-designed product has well acceptance and reduce fatigue of the workers [10,11].

Today ergonomics and occupational safety and health need more consideration (IEOM13). In development of technology and specialized work requiring repetitive task needs ergonomics [11]. Repetitive work on improper working conditions impact on musculoskeletal health [12]. During developing ergonomics on the existing products it considering the existence variability of the populations [13]. Embedding ergonomic consideration to productise it taking accounts in to both psychological and physiological needs for user helps to in hence user efficiency, productivity and satisfaction [14,15]. Then by using ergonomics principles possible to reduce ergonomics problems [16]. Before improving the exits hot pale/stove, it needs to consider on human body (Anthropometric) and posture of the users with the overall dimensions of the stove. Using proper ergonomically designed stove in kitchen is used to reduce fatigue (back and knee pain) of users and increase satisfaction from work with safety [17,18].

STATEMENT PROBLEM

An electric stoves or electric range is an integrated electrical heating device to cook and bake. Electric stoves became popular as replacements for solid-fuel (wood or charcoal) stoves which have required more labour to operate and maintain. Electric stoves may have single or multiple cook tops and be controlled by a rotary switch with a finite or infinite number of positions, each of which engages a different combination of electric resistances and hence a different heating power. Some may have a thermostat to switch power on and off and to control the average heating effect of the elements. Electric stoves are widely used in the households and commercial kitchens in Ethiopia. During usage of hot double hot plate there are some problems, because of the ergonomically related problems and also not comfortable for users. The lower back area is made up of vertebral bodies, discs that act as "shock absorbers. When work repetitively and fully stretching downward through the time back pain is occur on the users. Hip pain can also other pain formed during uncomfortable system of doing the works, weakness of the muscles in the hip can reduce pelvic area support and cause back pain. Increased internal rotation of the femur can lead to knee pain. Hip pain and dysfunction can certainly cause knee and low back pain. Knee pain is also tightness of the iliotibial band can manifest as hip problems and cause pain to the outside of the knee. Tightness to the rectus femora's muscles, a muscle responsible for straightening the knee, can cause both hip and knee problems. Knee pain and dysfunction can certainly cause hip and low back pain. Those all pain is because of the ergonomically existence of the problems on the products (hot double plate). This research should be solve exist problems by developing ergonomics on the existing hot double plate.

Objective of the project

General objective: To develop ergonomics on exists of hot double plate in order to satisfy the users.

Specific objectives:

- To assess the existing problems of double coil plate electric stove.
- To design foot of the stove by the height of 55 cm from the ground.
- To increase satisfaction of the double coil plate electric users.

METHODOLOGY

Under this methodology it consider how the steps paper is processed, what types of data uses, how the data is analysed and material is used is located. In this case it consider the average of the population dimensions used depend up on the age which used the stove. Data is considered according to averagely fit all the users of the hot plate/ stove, because all dimensions are taken within the age of the users that material. This study only considering on the height of the knee of users, because the main target is to reduce the height between the stove and the knee during work by increasing the of the stove height from the ground (Figure 1).

Research framework

Exist hot double plate/stove:

- Have not foot or height from the ground and it attached to ground.
- It's difficult for cooking for user.
- Its causes of back and knee pain on the users.
- It requires improvement or develop ergonomics (Figure 2).

Type of data uses: The instruments engaged in order to collect primary data is structured questionnaires, direct observation and personal interviews and use secondary data like relevant books, articles, reports and data from previously worked researches. Both primary and secondary used to identify existing of the ergonomically problem on hot plate.

Data analysis equipment and tools: The tools will use for the data analysis to show both the existing and the propos methods, the equipment includes, metre, record sheet and calculator.

Gathered and analysed data: During gathering data we consider the age of the users peoples and the user's age most probably included between 15-65 ages. Then for this article use ten user dimensions and recorded with knee height in order to identify the height which related with seating position (Table 1 and Figure 3).

Material selection criteria: During selection designing this stove, it consider type of materials which going to select, because, to identify the relationship between exists materials and electric property. It consider some terms during selection of materials for designing the foot and other materials of the stove. So it consider the :non-conductive electric material, good strength material, lightweight materials, heat resist materials, corrosion resist materials, non-magnetic, less cost and easily availably material.

Types of material selected: Machined Wood**:** Depend up on the above criteria it select wood for designing foot of the plate. Because it is available and we can easily get from local. Bolt and Nut: both are needs according to their requirement dimensions.

RESULTS AND DISCUSSION

Existing problems of hot double plate/stove: It was already identified the existence of the problems on the hot plate/stove by using both questioners and direct observation. There are some ergonomically problems on that stove because stove hasn't foot, it is directly put on the land (ground) and use it. On the other hand there is no distance/height or space between the land (ground) and the stove. Users do their job always fully stretching to down ward, but the body and age of all peoples are not the same so it's difficult to stretch beyond of his ability during doing their jobs. Not only this but also, the back body of the user of the stove is concave to downward during uses. The duration of using that stove is at least three time per day, so this problem it affect the peoples those uses glory hot plate stove. After a long period of time the output of this problem is back pain and knee pain happened on the peoples (Figure 4 and 5).

Ergonomically improvement: When it improve this plate it considering the existence of different peoples/users, body size of the users also different. Depend up on the gathered data it considering between 15 to 65 ages of the peoples height of the knee in average 55 cm and hand reach (length) in average 45cm. also the design considering seating working condition of the work with normal working area. By using solid work software design foot with height of 55cm and assemble by using bolt and nut (Figure 6).

Material specification: Machined wood, Specifications nut and bolt (Table 2 and 3).

Assemble place on existing plate: When it assemble without affecting the exist plate. Then 4cm away from electric wire and 4 cm inter to beside of the body (Figure 7).

Total height of the plate from the ground is: Length of plate foot+thickness bend foot of subtained by nut+thickness of origional plate

48 cm+3 cm+4 cm=55 cm.

Then depend up on the gathered data get average dimension wich reperesent the people age located between 15 to 65 age. When it design and assemble the over all of the plate by using solid work 2017 software it as follows (Figure 8).

System of Packaging the plate after manufactured: After manufacturing the hot double plate it will pack with foots, bolts and Nuts without assembling, but show the way to assemble on bill of the material for customers and others.

Outcome of the study (paper): The improved (designed) hot double plate have: Height from the ground is increased from 0 to 55 cm, downward bending and stretching of the users totally reduced, hot double plate is comfortable for users seating on chair during use, back and knee pain of the user is also reduces and satisfaction of the users are increase (Figure 9).

CONCLUSION

Hot double plate/ stove is an integrated electrical heating device which used to cook, bake and stew. Major number of the populations of Ethiopia those living in urban (city) uses this double coil hot stove for prepares stew. There are some ergonomically problems on that stove. This stove hasn't foot; it is directly put on the land (ground) and uses it. Users do their job always fully stretching to down ward, but the body and age of all peoples are not the same so it's difficult to stretch beyond of his ability during doing their jobs. After a long period of time the output of this problem is back pain and knee pain happened on the peoples. This paper (project) developed ergonomics on the glory hot double plate stove in order to solve exist of the problems. This problems solved through ergonomic system make/ design the foot in both direction for exist stove, in order to make space in **55 cm** between the ground to the stove for easily appropriate for use.

Generally, the improved material decrease the back and knee pain from the users and users easily use after the foot is bind by using nut and bolt and also the manufacturer easy to pack without assembling and showing the way to assemble on the bill of the materials.

RECOMMENDATION

The manufacturers of the hot double plate should be consider the ergonomics before producing the products. Not only this but also it consider diversity of the people use the products, those peoples has different body size and age.