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Research Paper

Design compatibility of hand tools

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■ **ABSTRACT :** Hand tools are ubiquitous and they are integral to our daily routine. Workers in agricultural work, industrial occupation and home makers in kitchens make intensive use of hand tools, and poor tool design can adversely affect user's performance and lead to increased accidents and injuries. Kitchen tools aid to perform the job safely, efficiently and comfortably even in adverse working conditions, reinforcing strength and effectiveness of hands. The problem arises with the selection of right tool with the availability of variety of tools in the market ensuring comfort and safety. The present study is an attempt to know user's opinion about the design and comfort features of the kitchen tools used by them. Twin cities of Hyderabad and Secunderabad were selected for the study. A total of 120 employed home makers were identified as the sample and a self-structured interview schedule pertaining to tool possession, frequency of tool use, user identity, years and duration of use of tool, and feeling of convenience while using the tool were studied. The results of the survey revealed that peelers, kitchen tongs and graters are the tools, which are very useful but are felt stressful and comfortable to use. Results of the study confirmed that the existing kitchen tools have certain design flaws in user's point of view and require modifications to improve user's comfort and efficiency.

■ **KEY WORDS :** Kitchen tool, Hand tool, Comfort, Efficiency

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The first decades of the twentieth century saw the pace of business, industry and the society accelerates with the introduction of new technology. The added machine, motorized factory equipment, sophisticated household gadgets and hand tools urged people to pick up the pace of daily life and work. The human characteristic of getting used to the environment and tools sometimes lead to undesirable situations. One of the basic reasons for the poor fit between the users tools and the work environment, is the ignorance of ergonomic concern among the designers and users. This may lead to high forces while using the tools and adapting to uncomfortable postures. Such conditions result in cumulative trauma disorders, occupational injuries, accidents and stress to the user.

One of the most significant developments in the home during recent years has been its mechanization. Today an average Indian family boasts of possessing a wide variety of small and large tools, which have greatly reduced the back breaking work involved in home making. Many home makers both experienced ones and beginners, need to step back and look at the kitchen tools from a new perspective whether it reduces work or makes it easier or pleasanter or whether it makes the work more tedious.

Every woman with the great responsibility of running a home wants to have her home well equipped to make the best use of every moment. Cooking is the most important activity in all homes, but as every body knows, most of the work takes place, before the cooking stage is reached. Kitchen tools *i.e.*, knives, peelers, graters and the rest may be small in themselves, but their efficiency matters a lot. The right kitchen tools reduce the time needed for a job and whittle away the drudgery.

Hand tools are crafted for uncounted specific application as well as for general purpose activities. Hand tools are extensions of human hand, which are used to perform a job safely, efficiently and comfortably in adverse working conditions. The development of the tools with the rapid pace of industrialization and mechanization made the designers to

ignore the users aspect. The ill designed tools have several undesirable consequences leading to accidents and injury (Graffin, 1996).

Research shows that hand movements affect interstitial fluid pressure within the carpel tunnel, and any increase in pressure can compress the median nerve and other structure (Kapandji, 1992). Extreme hand position, such as acute flexion combined with ulnar deviation, can prevent the free flow of blood and other fluids into the palm of the hand, where as these flow freely into the palm with the hands in neutral to moderate extension (less than 20^0) or flexion (less than 20^0) (Gelberman *et al.*, 1994). Based on the results of the pilot study, the kitchen tools which were commonly possessed by most of the home makers were listed and their use was studied.

During the last century, industrialization has dramatically altered the work role of women in India. The joint family system is fast dying out. Family life is ever changing, new levels of living and concepts of society are developing, servants are becoming scarce and more women are coming forth for careers outside the home. The dual role of the home maker is imposing more stress on them. If the kitchen tools used by them are also ill designed, cooking would be cumbersome and very hard to accomplish leading to additional stress for women. Hence, the present research was conducted to study the user's opinion about the design and comfort features of the kitchen tools used by them.

■ RESEARCH METHODS

Twin cities of Hyderabad and Secunderabad of Andhra Pradesh were selected for the study. As per the Municipal Corporation of Hyderabad, the twin cities are divided into four zones. From each zone, two areas were selected through area sampling technique. From each area, 15 employed home makers were selected using random sampling technique totaling to 120 respondents from the four zones. To obtain a holistic picture of kitchen tools used by the respondents, a pre-tested self-made structured interview schedule was used comprising the information about the tool design and its comfort in handling the tools from the user's point of view.

■ RESEARCH FINDINGS AND DISCUSSION

The compatibility of various kitchen tools used by the respondents was studied. The feeling of convenience while using the tool, and user's comfort are the two vital parameters to make any hand tool compatible. The study was carried out emphasizing these two parameters and the results are presented as under:

Use of kitchen tools :

Cooking is the most common activity in every home involving the use of kitchen tools like knives, peelers, graters, tongs, beaters etc.

Possession of the tools :

It is evident from Table 1 that cent per cent of the respondents possessed knife. 86.67 and 74.17 per cent of the respondents possessed peeler and kitchen tong, respectively. Grater was possessed by 61.67 per cent of the sample. Only 21.67 and 15.83 per cent of the respondents possessed potato masher and tomato slicer, respectively (Fig. 1).

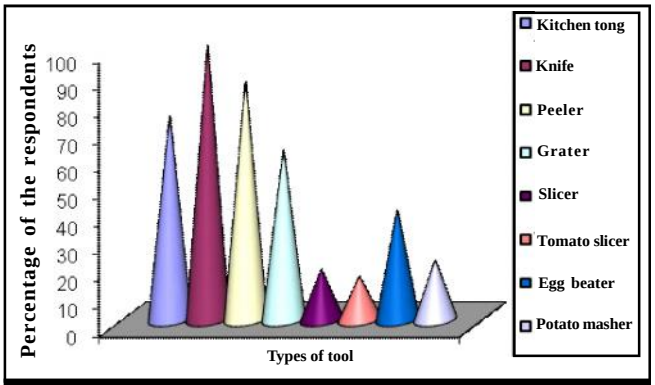

Fig. 1: Possession of kitchen tools

Frequency of use of kitchen tools :

The data portrayed in the Table 2 clearly indicate that majority (86.67%) of the respondents used knife more frequently *i.e.* thrice a day and only 1.67 per cent of the

Table 1 : Type of tools possessed **(n=120)**

Name of the tool	Respondents
Kitchen tong	89 (74.17)
Knife	120 (100)
Peeler	104(86.67)
Grater	74(61.67)
Slicer	22(18.33)
Tomato slicer	19(15.83)
Egg beater	48(40.00)
Potato masher	26(21.67)

(Figures in the parenthesis indicate multi response percentages)

sample used it only once a day. The kitchen tong was used by 7.87 per cent of the respondents thrice a day. Majority (70.27%) of the respondents used grater once a week followed by 18.99 per cent using grater twice a week. Egg beater was rarely used by 20.83 per cent of the respondents and 4.17 per cent never used it.

User identity :

On enquiry through personal interview schedule about the user identity, it was found that in addition to the home maker even the husband and children used most of the kitchen tools, but as the home maker is the main user of all the kitchen tools, the study laid thrust only on the aspects concerned to the home maker.

Years of usage of tool :

It can be seen from Table 3 that less than twenty per cent of the respondents were using knife (18.33%) and grater (16.22%) for more than 5 years. Cent per cent of the users of potato masher possessed it from a period ranging from 3-5 years. Cent per cent of the respondents were using tomato slicer from less than one year.

Duration ofr use :

It can be noted from Table 4 that cent per cent of the respondents used grater for 30 minutes and more. Knife was

Table 2 : Frequency of use of kitchen tools

Name of the tool	Frequency of use						
	Once a day	Twice a day	Thrice a day	Once a week	Twice a week	Rarely used	Never used
Kitchen tong (n= 89)	5(5.62)	3 (3.37)	7(7.87)	-	-	62(69.66)	2(13.48)
Knife (n= 120)	2(1.67)	14(11.67)	104(86.67)	-	-	-	-
Peeler (n= 104)	4(3.85)	-	-	6(5.77)	63(60.58)	24(23.08)	7(6.72)
Grater (n= 74)	2(2.7)	-	-	52(70.27)	14(18.99)	6(8.19)	-
Slicer (n= 22)	-	-	-	-	5(22.73)	14(63.64)	3(13.64)
Tomato slicer (n= 19)	-	-	-	12(63.16)	-	7(36.84)	-
Egg beater (n= 48)	_	-	-	32(66.67)	4(8.33)	10(20.83)	2(4.17)
Potatomasher (n= 26)	_	_	_	4(15.38)	2(7.69)	18(69.23)	2(7.69)

(Figures in the parenthesis indicate percentages)

Table 3 : Years of usage of tool

Name of the tool	Years of usage			
	< 1 year	1-3 years	3-5 years	>5years
Kitchen tong (n= 89)	-	46(51.68)	43(48.32)	-
Knife (n= 120)	6(5.00)	36(30.0)	56(46.67)	22(18.33)
Peeler (n= 104)	-	102(98.02)	2(1.92)	-
Grater (n= 74)	2(2.70)	2(2.70)	58(78.38)	12(16.22)
Slicer (n= 22)	2(9.09)	4(18.18)	16(72.72)	-
Tomato slicer (n= 19)	19(100)	-	-	-
Egg beater (n= 48)	16(33.33)	15(31.25)	17(35.42)	-
Potato masher (n= 26)	-	-	26(100)	-

(Figures in the parenthesis indicate percentages)

Table 4 : Duration of use of kitchen tools per use

Name of the tool	Duration of use/use			
	< 10 mts	10-15 mts	15-30 mts	30 mts and more
Kitchen tong (n= 89)	89(100)	-	-	-
Knife (n= 120)	89(74.17)	20(16.67)	81(67.5)	31(25.83)
Peeler (n= 104)	20(31.66)	81(86.04)	15(14.83)	-
Grater (n= 74)	-	-	42 (64.25)	74(100)
Slicer (n= 22)	22(100)	-	-	-
Tomato slicer (n= 19)	19(100)	-	-	-
Egg beater (n= 48)	48(100)	-	-	-
Potato masher (n= 26)	26(100)	-	-	-

(Figures in the parenthesis indicate multiple response percentages)

used for 30 minutes and more by 25.83 per cent of the respondents and by 67.5 per cent of the respondents for 15-30 minutes. The duration of use of slicer, kitchen tong, egg beater, tomato slicer and potato masher by all the home makers was less than 10 minutes.

Convenience while using the tool :

It can be seen from Table 5 that majority of the users of kitchen tong (94.38%), grater (85.13%) and peeler (87.5%) were feeling inconvenient to use the tool, while only less than ten per cent of the respondents expressed inconvenience using the remaining tools. Majority (97.8%) of the respondents felt kitchen tong is difficult to use. Only two per cent felt that it was efficient to use. Handling of knife was felt uncomfortable by only 5.0 per cent of the respondents. Majority (85.58%) of the users of peeler expressed that it posed health and safety hazards. Only 5.41 per cent of the respondents felt using grater saved time and energy. Cent per cent of the users of tomato slicer felt convenient to use it. Majority (92.30%) of the users of potato masher felt that it was comfortable to handle.

Even though most of the kitchen tools are possessed by the respondents, the frequency of their use was less as the design features of the tools are not user friendly and they do not feel comfortable and easy to handle them. Among all the kitchen tools studied, knife was possessed by cent per cent of the respondents and the frequency of use of it was also more, as it is an essential tool in day to day activities and it can be used multipurposively. It is evident that even though 75 per cent of the sample possessed kitchen tong, majority of them rarely used it as they felt that napkin was safer to hold and lift vessels whereas tong is accident prone due to lack of grip and heavy vessels cannot be lifted with it due to it's low weight bearing capacity. The out come of the study coincides with the study on kitchen tong by Ray *et al.* (1990) who revealed that majority of the respondents possessed kitchen tong but they did not use it as they were not comfortable in using it.

The use of grater was felt tedious, time taking and uncomfortable to use and so it was used by the majority of respondents only once a week. The duration of use of kitchen tools depends up on the purpose of use, as tong is used only to lift and hold vessels it is used only for less than 10 minutes where as the duration of use of grater is 30 minutes or more as it is used to grate varieties of foods and the duration of use depends upon the type of food and the amount of food being grated too.

The mass of the container to be lifted falls on the user's wrist while using kitchen tong and this is due to its less weight bearing capacity leading to user's inconvenience in using the tong. Users do not feel comfortable in using peelers and graters, as more force has to be applied while using them and while using graters, force has to be applied by both the hands along with repetitive movements leading to health and safety hazards. The results are in confirmation with the study

Table 5 : Distribution of sample according to feeling of convenience while using the tool

Name of the tool	Convenience feeling										
	Yes	No	Comfortable to handle	Easy to use	No health and safety hazards	Efficient to use	Saves time and energy	Uncomfortable to handle	Difficult to use	possess health and safety hazards	Inefficient to use	Do not save time and energy
Kitchen torg (n= 89)	5(5.62)	84(94.38)	4 (4.5)	2 (2.22)	5 (2.24)	2 (2.24)	4 (4.5)	85 (97.8)	87 (97.8)	84 (84.33)	87 (87.76)	85 (95.95)
Knife (n= 120)	104(86.67)	16 (13.33)	114 (95.0)	116 (96.67)	101 (84.17)	116 (96.67)	104 (86.67)	4 (5.0)	4 (3.33)	9 (5.83)	4 (3.33)	6 (13.33)
Peeler (n= 104)	13(12.5)	91(87.5)	14 (13.46)	19 (18.27)	15 (14.42)	21 (20.19)	23 (22.11)	90 (66.54)	85 (81.73)	89 (85.58)	83 (79.81)	81 (77.89)
Grater (n= 74)	11(14.86)	63(85.13)	4(5.41)	2 (2.70)	2 (2.70)	3 (4.05)	4 (5.41)	70(94.59)	72 (97.30)	72 (97.30)	71 (95.95)	70 (94.59)
Slicer (n= 22)	18(81.82)	4(18.18)	20 (90.90)	19 (90.90)	20 (90.90)	20 (90.90)	21 (95.45)	2 (9.10)	3 (13.64)	2 (9.10)	2 (9.10)	1 (4.55)
Tomato slicer (n= 19)	19(100)	-	19 (100)	19 (100)	19 (100)	19 (100)	19 (100)	-	-	-	-	-
Egg beater (n= 48)	39(81.25)	9(18.75)	40 (83.33)	42 (87.5)	42 (87.5)	40 (83.33)	43 (89.58)	8 (16.67)	5 (12.5)	6 (12.5)	8 (16.67)	5 (10.42)
Potatomasher (n= 25)	22(84.62)	4(15.38)	24 (92.30)	23 (88.5)	24 (92.31)	23 (88.46)	24 (92.31)	2(7.69)	3 (11.5)	3 (11.5)	3 (11.54)	2 (7.69)

(Figures in parenthesis indicate multiple response percentages)

conducted by Putz-Anderson (1998) who revealed that the application of force increases the gravity towards occupational risk factors and the users do not feel comfortable in using that particular tool.

Conclusion :

Hand tools are used for various purposes in our day to day life. Hand tools are extension of human hand, which are used to perform a job safely, efficiently and comfortably. The development of tools with rapid pace of industrilisation and mechanization made the designers to ignore the user's aspect. Cooking is the most common activity in all homes. Women spend most of their time in the activity and use of variety of hand tools. If these hand tools are not designed for efficient and safe operation, they lead to injuries and accidents. It is evident from the present study that the users are not comfortable with the kitchen tools available in the market. Users comfort has to be kept on priority while designing the kitchen tools to enhance their safety and efficiency.

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