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Prevalence of WMSDs and Task Characteristics of Manual Baking Activities in Bakeries

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Abstract: ***A baker is a person making and trading products such as breads, cakes etc. made up of flour. The place where baker works is named as a bakery. Baking is a labor-intensive work. Bakers face a number of work-related challenges at their workplace. This paper focuses and emphasizes on the work-related challenges faced by bakery chefs in their workplace, i.e., Traditional bakeries. A study was conducted among 120 bakery workers working in various types of traditional bakery with the aim to investigate the prevalence of work related musculoskeletal disorders and discomfort. The specific objectives being to assess the psychological factors related to work. The surveying in different bakeries with a structured self – construction questionnaire, collected the data. Modified discomfort questionnaire was administered to record the extent of discomfort faced. The results recognized the need and urgency to reduce work related musculoskeletal disorders among bakery workers and task characteristics of manual baking.***

Keywords: bakery workers, WMSDs, Pains and Aches, Occupational Health, ergonomics

I. INTRODUCTION

The art of baking was developed early during the Roman Empire. The bakery industry is one of the largest and ancient segments in the food-processing sector in India. It offers huge opportunities for innovation, growth and job generation. In higher establishments, bakers are also considered as chefs. Bakery sector is divided in to three sector Biscuits, breads and cakes/patisseries. A baker is a person who prepares and sells biscuits, breads and other products made of flour with different variations using an oven or other concentrated heat source. Traditionally bakers usually follow their ancestor's recipe or follow their own trial and error recipes. Foundation course programs for aspiring bakers from an organization or culinary school get their hand –on involvement with preparation of dough, presentation skills etc https://smallbusiness.chron.com/bakery-industry-analysis-64831.html.

Ergonomics is the study of people's efficiency in their working environment, it is an applied science concerned arranging and designing the things people use safely so that people can use it efficiently. Effective application of ergonomics I work system must achieve a balance between providing worker safety as well as physical and mental wellbeing and job satisfaction. Many research studies showed the positive effect of applying ergonomics principle in workplace, machine, tool, environment and facilities (Shikdar and Das, 1995; Resnik and Zanotti,1997; Das and Sengupta).
https://www.researchgate.net/publication/322832164_Ergonomics_Investigation_of_Musculoskeletal_Disorder_Among_the_Workforce_of_Waste_Management_Industry_in_Nigeria

Bakers and other bakery workers are exposed to many work-related hazards in the daily course of duties. The study evaluates the response and tendency of discomfort faced by workers according to the category of work they perform. Body areas like head, neck, shoulders, and wrists, upper and lower back hurt the most while performing task such as lifting heavy weights, kneading dough, rolling dough etc. This musculoskeletal pain can be strongly linked with the postures adopted by the workers, namely repetitive use of arms and hands, static posture during work, and sustaining standing position that exerts excess load to the nervous system and somatosensory system https://www.semanticscholar.org/paper/Evaluation-of-the-musculoskeletal-problems-related-Sahu-Moitra/0318e7db1d0add80bb8a7c494bd0a8b7d0b6c1a3. Safety of bakery workers are contingent to psychological aspects like stress, work pressure, optimal works, etc. It also includes work environment studies like temperature, sound, vibrations glare etc.

The clear view of musculoskeletal disorder due to the hazardous working posture was significantly observed and it can be interpreted those inadequate guidelines for working posture are producing occupational health hazards among the workers. Moreover, it was stated that, as the age increases, muscles tend to get rigid and continuous exposure to physically stressful job, inflicts an additional load on the bones and muscles.

In addition, any physical hazards faced by the worker could debar them from these jobs and ultimately could impose fatal conditions upon them. Therefore, certain recommendations were specified, such as the implementation of proper workstation, work environment, workers should be allotted specific activity according to their experience, adequate rest breaks in between work period, while they should focus on avoiding awkward postures. Therefore, that it would help them in increasing productivity as well as the betterment of the workers. (Sahu, 2013).

The study concludes that the most critical level of risk is found in the activities that involve the use of repetitive tasks; these are tasks that must be modified by the excessive work rate, immediately due to the high risk they demand from workers. Regarding the postural load, the danger is additionally high, either thanks to bad postural habits, bad Job designs, or, all factors that cause conclude that exposed workers are potential candidates to develop musculoskeletal disorders in extremities superior and back to medium and future .

Very few researches consider the health of bakers working in the traditional bakeries; these bakeries sell their products with minimal profits and work to earn their livelihood serving in their locality. Most of these bakeries used traditional methods of baking which include more of manual practices of making the bread since many of them cannot afford to have advanced technology to mix and roll dough and other related activities, which can be done by machines. Many of the bakery workers are not aware of PPE's and basic first aid when injured with cuts or burn. This study wants to highlight the need to implement technological and/or Organizational improvements in the bakery jobs, technical actions such as the redesign of jobs or the implementation of machines as well as organizations such as the training of workers, the implementation of a health surveillance program that can detect any discomfort or damage that workers may suffer early should also be given immediately. https://www.researchgate.net/publication/325960688_A_Look_at_the_Ergonomic_Situation_of_the_Bakery_Industry_in_the_City_of_Quito_Ecuador

II. OBJECTIVES

The specific objectives of the study are to (i) understand the demographic profile of Bakery workers in Mumbai city and its suburbs ;(ii) investigate the association between musculoskeletal disorders and task characteristics of manual baking activities in a bakery; (iii) suggest ergonomic intervention for the prevention of musculoskeletal disorders among bakery workers.

III. METHODOLOGY

An exploratory study was conducted among one hundred and twenty bakery workers in the age group of 21 - 60 from nineteen bakeries situated in Mumbai and its suburbs, who were selected to participate in the study through snowball and random sampling technique. Being a labor-intensive profession, males dominate this field and hence only males were included in the study. A self-constructed and validated questionnaire was accustomed collect information. The questionnaire was divided into 5 parts: Part A – to collect information on the demographic profile of the participants; Part B – included questions probing the work – related information; Part C - comprises of participant's workplace hazard; Part D - incorporated questions related to Musculoskeletal Disorders and Part E comprises of work environment factors.

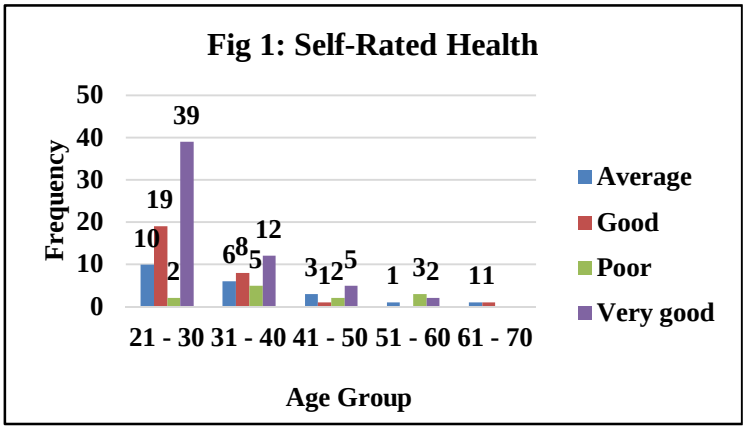
IV. RESULTS & DISCUSSION

A. Sample Profile

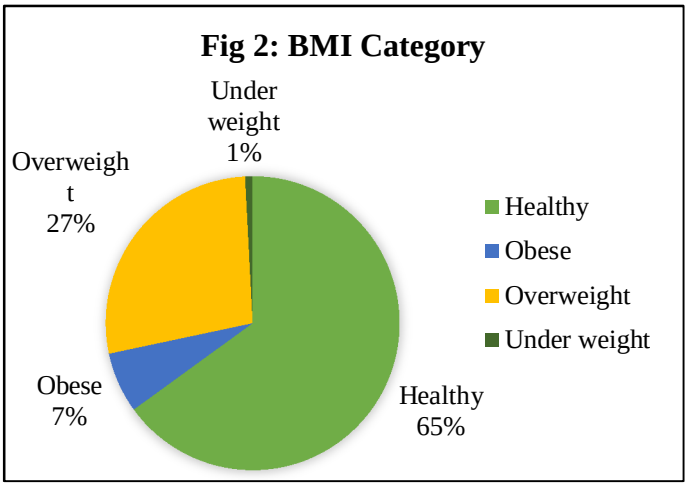
Table 1: Educational Qualification

Age Group	Below S.S.C.		Graduation		H.S.C.		No education		S.S.C.		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
21 - 30	12.0	10	2.0	1.6	18.0	15	5.0	4.2	33.0	27.5	70.0	58.3
31 - 40	9.0	7.5	0	0	2.0	1.6	11.0	9.2	9.0	7.5	31.0	25.8
41 - 50	4.0	3.3	0	0	0	0	7.0	5.8	0	0	11.0	9.2
51 - 60	5.0	4.2	0	0	0	0	1.0	0.8	0	0	6.0	5.0
61 - 70	0	0	0	0	0	0	2.0	1.6	0	0	2	1.6
Total	30	25	2	1.6	20	16.6	26.0	21.6	42.0	35.0	100%	

The average of the sample is 21-40, Age group between 21-30 have been completed their SSC that is 33(27.5%). As seen in Table 1, approximately 16.6% of the bakery employees in this study have passed their H.S.C. or below. 21.6% have little or no education. This is one of the many reasons why they cannot demand a permanent employment status nor can they lay down their salary expectations forcefully.



The above graph indicates ,11(9.1%) less than 5 years of experience bakery workers are designated as helpers, 3 (2.5%) less than 10 years of experienced bakery workers are designated as managers, 1 (0.8%) more than 40 years of experienced workers are designated as cashier, 17 (14.1%) more than 10 and less than 15 years experienced bakery workers are designated as bakers 4 (3.3%) less than cleaners and 8 (6.6%) having less than 5 years of experience bakery workers are designated as packaging person. As per personal interview, the bakery workers are usually hired based on their experience of work in a particular section of work, their salary depends on the hierarchy of the work ,e.g. 45year old cashier is paid more than the newly joined cleaner.



58 (48%) of the bakery workers rate their health as excellent (Fig 1) with no illness and medication working in the bakery. 29 (28%) of the bakery workers rated their health nearly as good.21 (14%) of the bakery workers rated as average due to some body pains and ache occurring one during while; 6 (5%) and 6 (5%) that is age group 51 to 70 rated poor due to fatigue, stress and illness. As per the interaction among the bakery workers, the youth feels healthy and active whereas by the time, workers reach the age of 40 and above they start having these choric diseases or weakening of the muscles and bones leading to low productivity of work.

The BMI category of 78(65%) of bakery workers are healthy; 8(7%) of bakery workers are obese; 33(27%) of bakery workers are extremely obese followed by 1 (1%) of bakery worker being underweight, which can be interpreted as 78(65%) of bakers is having a good BMI (Fig 2). Table 1 focuses on the educational qualification and training capability of bakery workers working in bakery. It was observed that the educational qualification is not a deterrent for employment in the bakery, it is the baking skills. 42 (35%) of workers completed their S.S.C., with the least number i.e., 2 (1.6%) of bakers who had completed their graduation.

Results also reveal that 26 (21.6%) are not educated, while 30 (25%) have not even completed their S.S.C. Generally, more experience can make up for the lack of education, as rightly quoted by Lakshmi Karthik and R. Rao. (2020) in the study titled "Ergonomic assessment of musculoskeletal discomfort among chefs in commercial kitchens" in Mumbai and its suburbs. The owners reported that they select the bakers mostly based on their experience, physical ability and not on the baker's educational qualifications (Table 1), as most of them are migrant workers and earn for daily wages, as it is a labor-intensive work hence, workers who are uneducated but with experience are hired for the job depending upon the kind of job.

As bakers age, their physical and mental ability tends to decline and the occurrence of accidents and diseases increases as they age (Fig. 1.1). As their age increased and their BMI increased and they fell into the category of overweight and obese. (Fig.1.4). the study shows that 33 (27.5%) bakery workers fall into Overweight category, whereas, 78 (65%) were under Healthy category with only 1 (0.8%) bakery worker in Underweight category (Fig.1.4).

Bakers have rated their self-rated health in the following categories of very good, good, average and poor. Where 58 (48.3%) rated their health status as being very good and 12 (10%) rated it as being poor.

B. Work Related Musculoskeletal Disorders (WMSDS)

(WMSDs) are a bunch of painful disorders of muscles, tendons, and nerves. Work posture, force of movements, Vibration, increase in work pressure can be some of the risk factors of WMSDs. Proper posture can boost your productivity and mood, as well as help you use your muscles more efficiently. Good posture supports good health; Proper body alignment can help prevent excess strain on your joints, muscles and spine. Owas (Ovako Work Posture Analysis System) a simple method to verify safety level, which relates to work posture and helps to evaluate risk level, which results in corrective action (Caputo et al., 2006).

Bakers usually perform many activities such as baking, cleaning, packaging, etc. Though posture analysis were done on all the tasks/activities of the entire day's work these three are chosen for discussion in this paper as the author felt these were the areas where many workers faced pain and repetition of work, which helped to study WMSDs among bakery workers.

The tasks chosen for further analysis are:

1) Lifting and Moving Heavy Trays
2) Kneading Dough
3) Rolling Dough

Task 1: Lifting and Moving Heavy Trays – Posture Adopted

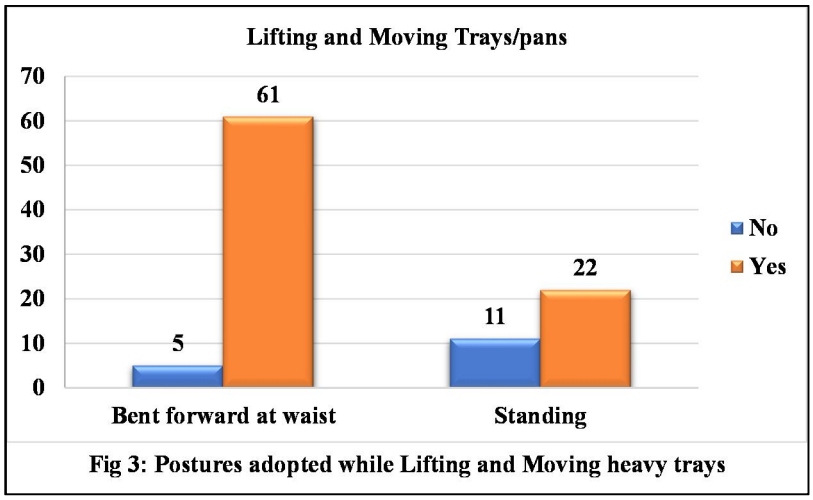


Fig 3: Postures adopted while Lifting and Moving heavy trays

Workers usually lift heavy aluminum trays having thick layers to avoid burning of the products, these are usually too heavy to carry along with the baked products and extremely high temperature of the trays when they are taken out from the oven ,they sometime use or does not use safety equipment to safeguard themselves from the hot vessel. 5(5%) worker's bent forward at waist while lifting and moving heavy trays believes that work has no negative effect on them whereas, 61(50.8%) believes that work affects them negatively. As correct postures can, be bending at knees and keeping back straight during the lift by tightening the stomach muscles while lifting trays.

Posture is an important aspect as proper techniques are essential to keeping your back healthy and functioning well in a work environment. 11(11%) workers are in standing posture while lifting and moving heavy trays, believes that work did not affect them negatively whereas, 22(18.3%) workers believes that work does affect negatively.

Posture adapted is standing, bent forward at waist. 66 (55%) bend forward at waist while lifting and moving trays whereas, 33 (27.5%) use standing posture while lifting and moving tray, workers who bend forward at waist believes that work affects them negatively.

Force required is medium. Stress level is low to medium. 49 (40.8%) lift and move heavy trays 20 – 30 times, 12 (10%) lift and move heavy trays 50 – 60 times and 3 (2.5%) lift and move heavy trays 60 – 65 times. Possible injuries/accidents, which may occur while performing the job -Trips, falls, cuts, burns.

Task 2: Kneading Dough – Posture Adopted

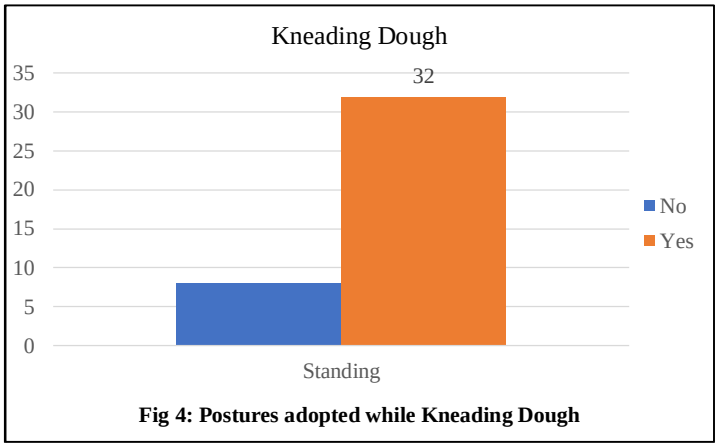


Fig 4: Postures adopted while Kneading Dough

8 (20%) workers knead dough in standing posture believes that work environment does not affect negatively.32 (80%) workers knead dough in standing posture believes that work environment does affect them negatively. Kneading of the dough usually requires lots of force and repetition of hand movements and standing for a long time, as standing for a long time all day is unhealthy, can cause inflammation of veins, and can be chronic overtime.

Workers knead dough after mixing process. Awkward posture adapted is standing, neck bent forward, wrist bent back and forth. Stress level is medium .66 (55%) workers who knead dough use force whereas, 53 (44.1%) workers do not knead dough. Workstation should be designed according to standard measurements. Enough rest breaks must be given in-between tasks requiring heavy force, awkward postures. Rest breaks can also help to alleviate potential work-related disorders.

Task 3: Rolling Dough – Posture Adopted

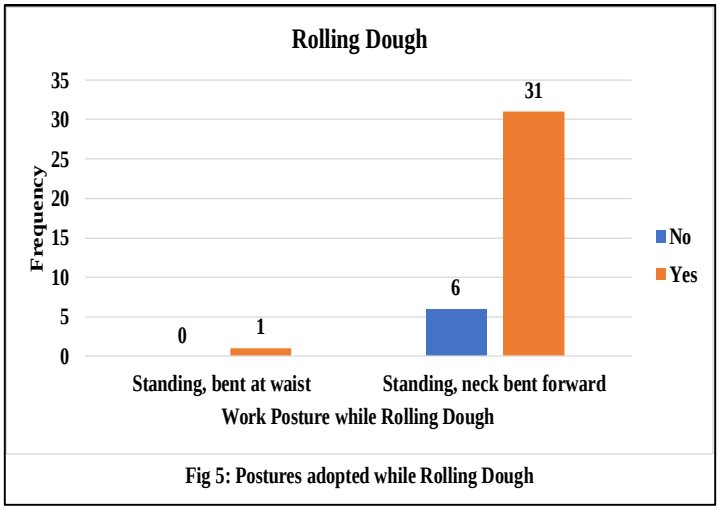


Fig 5: Postures adopted while Rolling Dough

1 (2.6%) worker (Standing, bent at waist) while Rolling dough believes that work environment does affect negatively; 6 (15.8%) workers (Standing, neck bent forward) while Rolling dough believes, work environment does not have negative effect whereas, 31 (81.6%) believes that work environment does have negative effect.

Postures adopted are Standing, neck bent forward and slightly wrist bent backward. 31 (81.6%) workers adopt posture of standing with neck bent forward while Rolling dough believe that work environment has negative effect on them. 28 (87.5%) workers roll the dough 50-60 times per hour with standing, neck bent forward posture. It should be noted that the most of the respondents reported that the symptoms slightly reduced their ability to work, and the frequency of the occurrence was almost daily, but mostly they were left untreated or neglected, they stopped working only when it was impossible to work as they depended on their daily wages. Rest breaks should be increased. Adequate illumination at workstation. Proper tools and equipment to be provided to improve the quality and quantity of work

While bakers work for long hours in bakery and exposed to hot environment and standing doing repetitive task affects their health. The bakers perform task of putting the trays in the hot oven and taking it out when it is baked from the oven using a big iron rod. Due to repetitive motions of the work, the baker's get exhausted and breathless since the surrounding temperature is more than the normal room temperature in the bakery. Hence, baker's need to be given frequent breaks to go out in fresh air for some time and back to work. Keeping work rotation among bakery workers helps them work faster rather than being exhausted. In addition, change in body posture is recommended for employees working for long hours. Bakery workers can take the help of the other workers while lifting heavy equipment and should take frequent breaks

V. SUGGESTIONS

Control methods suggested for these small bakery units must be unique and are intensely reliant on the circumstances that emerge because of daily hazardous activities performed. Control methods include strategies that are a framework, which can be utilized in industry to limit hazards. It is a generally acknowledged framework advanced by various wellbeing associations. Different representations are utilized to portray the framework, most regularly a triangle is used to understand control methods.

The control methods in this system are, arranged by diminishing adequacy:

1) *Elimination as Control Method:* Truly expel the risk — it is the best danger control. For example, if representatives must work with rusted or broken trays, which can harm them, the risk can be dispensed with by expelling the trays they are working with to kill the need to work with these issues. Elimination of trays, Discarding the defective tools, difficult procedures, etc. can benefit bakers.
2) *Substitution as Control Method:* Substitution, the second-best peril control, Substitution may also include using a machine that requires less energy, or lifting items with less weight includes substituting something that delivers a danger (like disposal) with something that doesn't create a risk — for instance, replacing rusted trays to more up to date ones that are lightweight. E.g., Instead of lifting flour packets manually, workers can use trolleys and other machines to make their work easier, substituting cloth with gloves, Substituting traditional baking methods with upcoming technology as much as possible.
3) *Isolation as Control Method:* Encapsulating the most hazardous area from rest of the workplace. For example, separating the baking area from the non-baking area-creating barrier for rest of the worker to work under favorable conditions. Such as workstation area, packaging area, store room etc.
4) *Engineering Controls:* The third best methods for controlling risks are engineering controls meaning, built controls. These do not dispense with dangers, but instead seclude individuals from risks. Capital expenses of designed controls will in general be higher than less compelling controls in the chain of importance, anyway they may lessen future expenses. For ex. managing platform design modifications, Ergonomic workstation and equipment design.
5) *Administrative Controls:* Administrative controls are managerial controls that bring about changes to the manner in which individuals work. Instances of regulatory controls incorporate methodology changes, worker preparing, and establishment of signs and notice names, (E.g., those in the Workplace Hazardous Information System, Rotating job assignments, Training and Awareness).
6) *Personal Controls:* Personal Protective Equipment (PPE) is least effective and cheaper method yet can be useful in emergency. It is an individual defensive hardware, which incorporate gloves, Nomex Uniform, respirators, hard caps, security glasses, safety and wellbeing gloves, security shoes, high-perceivability attire, and safety wellbeing footwear. PPE is the least viable methods for controlling perils as a result of the high potential for harm to render PPE ineffectual. Moreover, some PPE, for example, respirators, increment physiological exertion to finish an assignment and, in this manner, may require clinical assessments to guarantee bakers, that they can utilize the PPE without taking a chance for their safety and wellbeing.

VI. CONCLUSION

Bakery and bakery products are one of the most favorite delicacies we love to have, but we do not give a second thought what can be the situation of the workers working in such hot environment, which low wages, since it is a labour intensive work. We can conclude that this study will help us give an ergonomic perspective to enhance both the health and wellbeing of the worker as well as organization.

There are many problems faced by bakery workers such as pain in lower back because of frequent bending and continuous lifting of heavy equipment's or flour packets, pain in shoulder which can happen due to various tasks performed in the bakery like kneading the dough, rolling the dough etc., without adequate break so the continuous repetitive movement can cause pain in the shoulder and upper arm region, Pain in the lower leg and foot region can be due to standing for long working hours. Almost all the bakery workers have to stand for a long period without rest breaks this is the reason the bakers have reported pain in their lower leg and foot region.

All these problems interfere their work ability which means these pains and discomfort interfere the work/ task performed by them hence lowering the productivity of the Bakery. Many of the bakery workers had mentioned that because of performing the same job regularly it has been their habit due to which they do not feel any pain but some still complain that they do find difficulty while performing the task or adopting to some new tasks. Some of them even mentioned that due to working in heat for long hours, the sweat goes in their eyes and accidents can occur due to this.

All these problems have only one solution, which is to follow the control methods, which are Elimination control, Substitution control, Isolation control, Engineering control, Administrative control and Personal Protective Equipment's (PPE). Among these, engineering control though is the most expensive of all but it is also the most effective. The suggestions given are some of the ergonomic suggestions. Implementing these will help the bakery workers to face less problems while working.

VII. ACKNOWLEDGEMENT

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3) *Conflict of Interest:* The authors declare that they have no conflict of interest.
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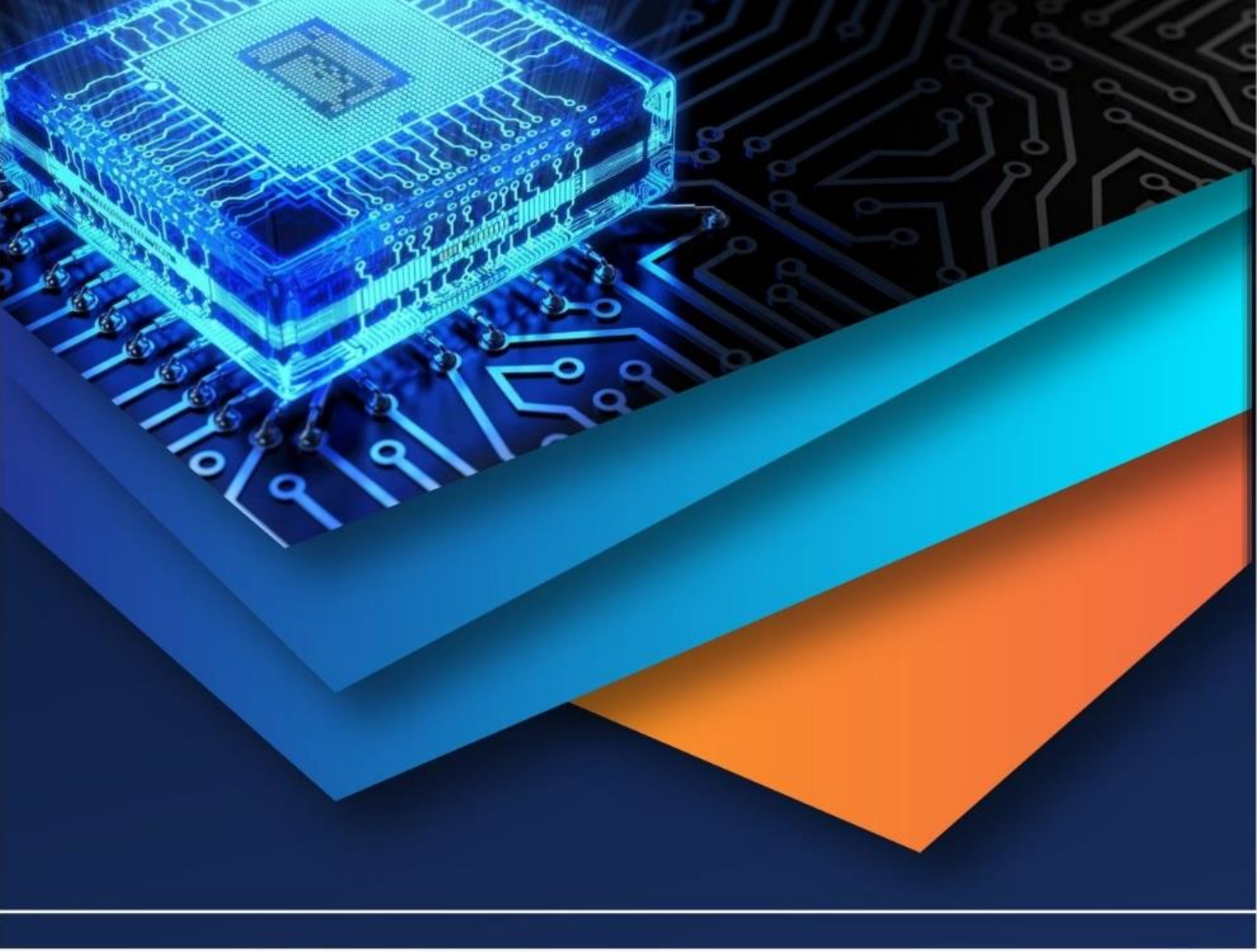

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