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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDE AND PRACTICE OF GENERIC MEDICINES AMONG DENTAL GRADUATES AND POSTGRADUATE STUDENTS OF NORTH MAHARASHTRA REGION.Shruti Kare¹, Asmita Ramesh Hamand,

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E-mail: asmihamand@gmail.com**Received:** Apr 5, 2025; **Accepted:** May 10, 2025; **Published:** May.31,2025**ABSTRACT****Background:** Rising healthcare costs are a global concern, especially in developing countries where nearly 80% of healthcare expenses are paid out-of-pocket. A major contributor to this expenditure is the cost of medications. Generic medicines, which are therapeutically equivalent to branded drugs and significantly more affordable, offer a practical means to reduce healthcare costs while maintaining treatment standards. Despite India being a leading producer of generic drugs, their prescription—particularly in dentistry—remains underutilized.**Objective:** To evaluate and compare the knowledge, attitude, and practice (KAP) of dental students regarding generic medicine prescription.**Method:** A cross-sectional survey was conducted in December 2019 among 100 participants (22 MDS students and 78 interns) at the School of Dental Sciences, Karad, Maharashtra. A self-administered, pre-validated questionnaire with 15 items was used to collect data on demographics and KAP related to generic medications. Responses were recorded in dichotomous format (Yes/No), and one open-ended question sought suggestions for promoting generic use. Data were analyzed using Microsoft Excel and MedCalc software; the chi-square test was applied for statistical comparison.**Result:** Participants had a mean age of 23.14 years; 76% were female. Only 52.4% knew generics share the same composition and dosage as branded drugs, and 31% knew repeated clinical trials are not required for generics. About 31% believed branded medicines are more effective, and 54.8% felt generics are often manufactured in substandard facilities. Just 47.6% reported prescribing generics, and 69% had never read comparative studies between branded and generic drugs. The most influential factors in prescribing decisions were patients' economic status (85.7%) and drug efficacy/safety (83.3%). Most participants supported implementing awareness workshops, educational training, and stricter regulations to improve generic prescribing habits.**Conclusion:** Despite policy efforts, the prescription of generics among dental professionals is limited due to knowledge deficits and ongoing misconceptions. Targeted educational programs, mandatory training, and regulatory reinforcements are necessary to foster confidence in generic medications. Expanding this research across institutions will offer more generalized insights and support national strategies to enhance access to affordable healthcare through rational prescribing.**Keywords:** generic medicines, educational programs, dental professionals, dental graduates, postgraduate students**1. INTRODUCTION**

The increasing health-care expenditures remain a serious concern for the health-care system worldwide. In developing countries approximately

80% healthcare expenditure is paid from patients' pocket.¹ As patient is bearing the cost of treatment themselves, it is necessary to keep health-care expenditure minimal without compromising the quality

of care. One of the major components of health-care expenditure is cost of the medicines.² The price of generic medicines is 10-80% lower than their branded equivalents. Hence, the usage of generic medicines can improve the access to health-care without conceding the quality.³ Generic medications are substitutes for original, branded medications that are just as safe, effective, and of comparable quality. In clinical practice, prescribing generic medications can drastically reduce health care costs. This can also assist government organizations and health care payers⁴. Increasing the use of generics can assist provide high-quality healthcare to the vast population of India, given the country's limited resources. This will increase the population's capacity to afford high-quality healthcare services⁵.

Various stakeholders in the Indian context have made a number of steps to promote the use of generic prescriptions in clinical settings. In 2018, the Medical Council of India revised its code of conduct for physicians, advising all doctors to prescribe medications with generic names⁵. This program's objective is to provide high-quality, unbranded medications reasonably priced and accessible to the nation's impoverished citizens. Even though there were 3200 Jan Aushadi outlets open in India as of 2018, this was still insufficient to satisfy the needs of the Indian populace⁶.

In the Indian context, generic prescription is not widely used, despite all the efforts. Branded medications account for 90% of the domestic pharmaceutical business in India, which is worth at least Rs. 1,000,000 crore⁷. It is evident that there are not enough generic name counterparts of branded medications available in the Indian market, even though India is one of the world's largest producers and exporters of generic medications⁸. Numerous studies have demonstrated that one of the main barriers to the adoption of generic prescribing is the way doctors see generic medications.^{9, 10}

Additionally, it has been noted that one of the obstacles to the adoption of generic prescription is a lack of knowledge regarding the regulatory requirements utilized in generic manufacture.¹¹ One of the main obstacles to prescribing generics is a lack of understanding about them. This study aims to evaluate dental professionals' knowledge about generic prescription.

Aim

To compare the knowledge, attitude, and practice of dental students on inexpensive prescribing.

METHODS

In December 2019, a cross-sectional survey was conducted among postgraduate (MDS)

dentistry students and interns. After receiving approval from the Institutional Ethics Committee (136/2024-2025), the study was carried out at the School of Dental Sciences, Karad, Maharashtra. The survey comprises self-administered, pre-validated questions relevant to the Indian context. These inquiries were drawn from published works about Indian setup.¹²⁻¹⁵ The questionnaire included 15 questions regarding participants' demographic information as well as their knowledge, attitude, and practice (KAP) of generic medications.

Ten questions on generic medicine knowledge, five questions about participants' attitudes toward generic medicine, six questions about generic medication practice, and one question asking for recommendations to enhance generic prescribing in India were all included in the questionnaire. Dichotomous replies (yes or no) were used to gather the responses. There was just one open-ended question asking for recommendations on how to enhance generic prescription in India. Ten institute interns were chosen at random to participate in the questionnaire's preliminary testing.

The purpose of the literature search was to locate studies evaluating dental practitioners' knowledge of generic medications in an Indian context. Data was gathered and analyzed using microsoft excel. The Med Calc statistical program was used to analyse the data collected from dentists.¹⁶ The Chi-squared test was used to compare the responses from the two investigations.

RESULTS

Of the 100 participants in this study, 22 were MDS students and 78 were interns. Participants are 23.14 years old on average. Of the participants, 24% were men and 76% were women.

Knowledge

The knowledge related questions and frequency of response of the participants is presented in Table 1. The chart shows that 61.9% of dentists concurred that generic medications were meant to be used in place of branded ones.

Just 50% of participants knew that generic medications were available on the market after the innovator drug's patent had expired, and 52.4% of dentists were aware that the composition, dosage, and indications of generic medications were identical to those of their branded equivalents. Thirty-one percent of survey participants knew that producing generic medications did not need repeating preclinical and clinical research.

Attitude

According to the data below, the majority of dentists

(76.2%) believed that generic medications did not have more adverse effects than branded ones.

Additionally, 31% of participants think that brand-name products are more effective than generics. In contrast to brand-name medications, over half of participants (54.8%) thought that generic medications were frequently produced in inferior facilities.

Medications. An further 50% of participants disagreed that generic medications are less expensive than name-brand ones because they are of lower quality.

Names of medications. Of the participants, three-quarters (76.2%) thought that more rigorous quality testing of generic medications was necessary. The majority of participants (81%) said that a training program should be established to raise patients' and physicians' knowledge about generic medications.

Practice

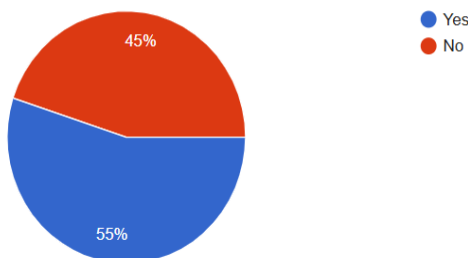
Pie chart provides a summary of the practice-related question and the participants' answers. 47.6% of participants, or over half, admitted to prescribing generic medications. Sixty-nine percent of participants had never read an article comparing the safety and

effectiveness of generic and name-brand medications. The vast majority of physicians, 45.2%, did not believe that transferring a patient from brand-name to generic medications might alter the course of treatment. An further 69% of participants expressed discomfort if the pharmacist switched the brands of medications they had been prescribed. Nearly half of respondents (54.8%) agreed that replacement should be used whenever a generic is available.

The patient's economic profile (85.7%) and the medication's effectiveness and safety profile (83.3%) were the two most important factors when prescription medication to patients. 76.2% of participants took into account the availability of medications at pharmacies, while 69% of people took the cost of medications into account. These two were the next crucial factors that determined which medication should be supplied. Just 45.2% of participants took patient demand to prescribe inexpensive medications into consideration. The participants recommended that a variety of workshops, seminars, and continuing education initiatives be used to raise awareness of generic prescription. Additionally, participants recommended that legislation pertaining to the prescription of generic medications be created and implemented.

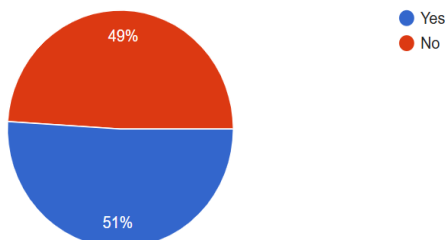
1) Generic medicines intended to be interchangeable with branded drugs ?

100 responses



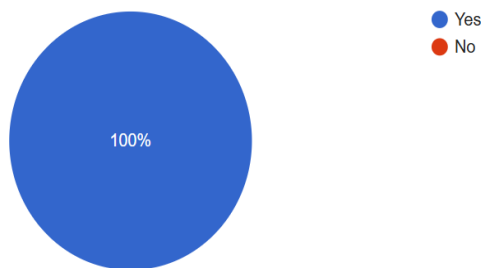
2) Composition, dose and indication of generic medicine are same as branded medicine?

100 responses



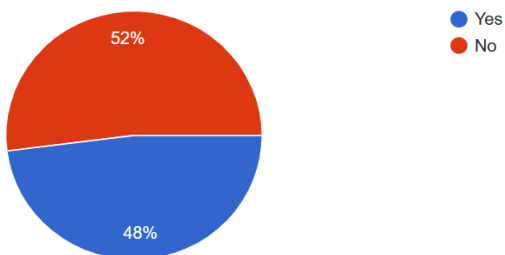
3) Bioequivalence is necessary for generic approval?

100 responses



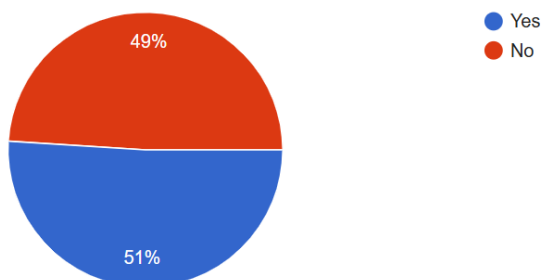
4) To reduce overall health expenditure generic medicine are important tool?

100 responses



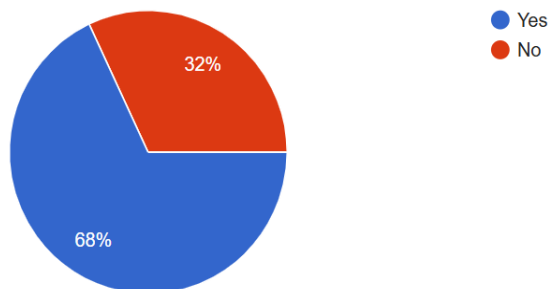
5) Brand name medicines produce lesser effect than generic medicine?

100 responses



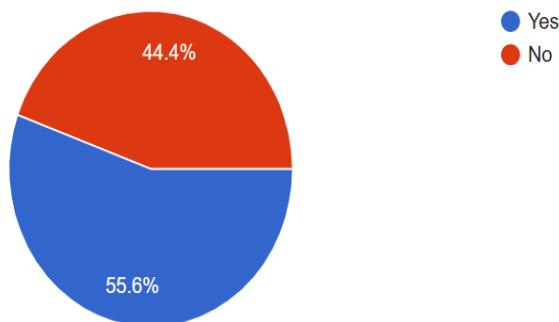
6) Generic are not as effective as brand names?

100 responses



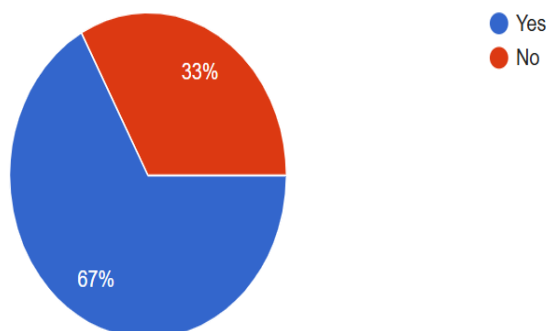
7) Brand name drugs are made in modern manufacturing facilities and generic are made in substandard facilities?

99 responses



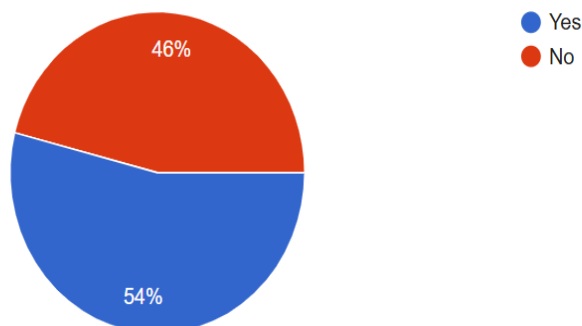
8) Generic drugs cost less because they are inferior to brand name drugs?

100 responses



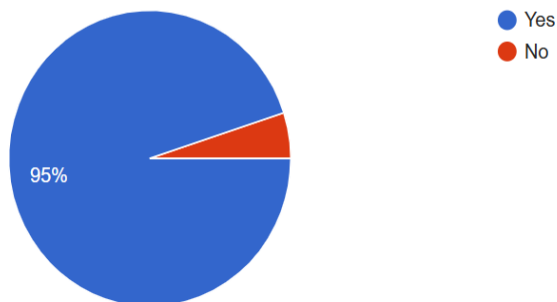
9) Quality testing of generic should be made more vigorous?

100 responses



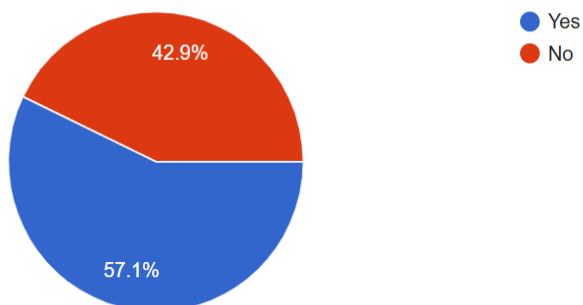
10) Do you think there should be training program to increase the awareness regarding generic drugs?

100 responses



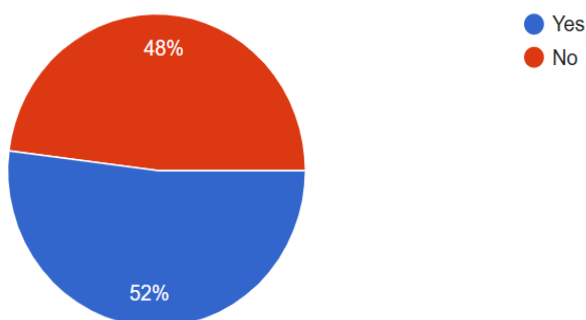
11) Pharmacist should be allowed to substitute the innovator drug with generic version?

98 responses



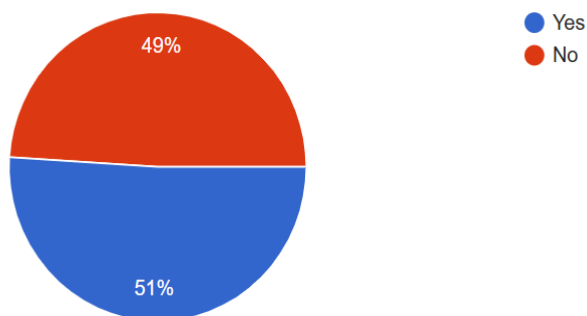
12) Do you prescribe generic medicine?

100 responses



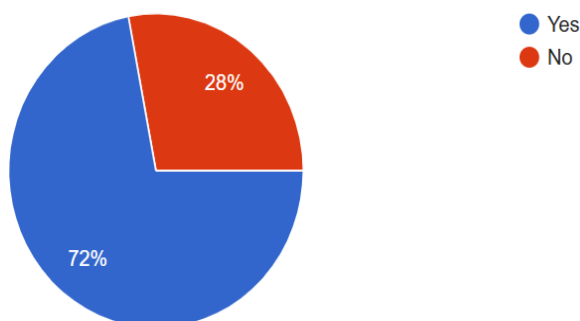
13) Have you anytime read any article on comparison of safety and efficacy of generic versus branded medicines?

100 responses



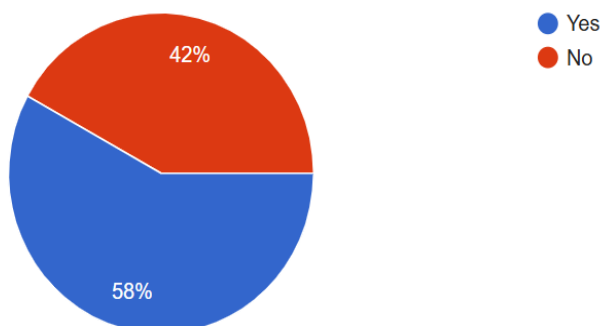
14) Do you think that switching a patient from a brand name to generics may change the outcome of the therapy?

100 responses



15) Do you support substitution in all cases where generic is available?

100 responses



DISCUSSION

To the best of the author's knowledge, this is the first study to be conducted in India that evaluates the KAP of generic medications among dental prescribers. In India, KAP of generic medications among medical practitioners has been conducted and published. According to a study, the global market for dental drugs is anticipated to grow at a compound annual growth rate (CAGR) of approximately 5.8% over the next five years, reaching 5720 million USD in 2024 from 4320 million USD in 2019.¹⁷ Similarly, the dental prescribing market in India is expanding rapidly at a rate of 8%. The market for dental prescriptions for specific disorders and oral care products is valued at nearly 550 crores INR.¹⁸

All of this highlights the fact that dentists are among the main prescribers of medications so their prescription procedures need to be revised. Several nations, notably Mexico, have stated that dental professionals frequently make prescription errors due to a lack of the finest pharmacological education¹⁹.

With a few exceptions, dental and medical professionals' perceptions and comprehension of generic prescription are often the same. Dental professionals had somewhat less understanding than medical professionals in areas including bioequivalence research, DCI regulation for prescribing generics, and the composition, dosage, and indications of generic medications. The setup discrepancies may be the cause. Typically, dentists practice in specialist clinics rather than mainstream hospitals.

The study's primary weaknesses are its small sample size and restriction to a particular institutional setup. Therefore, it is not possible to generalize the results of this study. The information provided by respondents is a major determinant of the research that use self-administered questionnaires. Even though participants were encouraged to complete the questionnaire on their own, factors including recollection bias and reciprocal impacts could not be totally removed. In order to understand the knowledge and practices of prescription writing, we advise that similar research be carried out in different regions of the nation.²⁰ We have just looked at how doctors view and comprehend generic medications. Adoption of generic prescription is also significantly influenced by patients' and other healthcare professionals' perceptions and comprehension.

Any policy or product's effective execution depends on the public's trust in its efficacy, safety, and quality. Numerous studies have demonstrated that one of the main obstacles to the widespread use of generic prescription has been the way doctors view these medications. According to a statewide poll conducted in Malaysia, 51.7% of

doctors said that generic medications are less effective than name-brand ones, indicating that doctors have a poor opinion of them. Additionally, 74.2% of doctors said that branded medications had far superior manufacturing and quality control standards than generic ones.⁹ Similar findings were revealed by another study carried out in Bosnia and Herzegovina. Sixty percent of respondents said that circumstances for generics production are worse.¹⁰

According to a different systematic research, how people see doctors depends on how developed the healthcare system is. Physicians in less developed healthcare systems describe significant differences in control procedures, requirements for generics' bioequivalence and manufacturer standards.²¹ A research was carried out in Ireland following the Health Act of 2013 made generic substitution lawful. Concerns with generic replacement in vulnerable patient populations, such as the elderly, the frail, those taking several medications, people with cognitive impairment, and people with anxiety, were brought to light by this study.²²

According to a research done in India, the quality of the branded and generic products was similar across a range of tests. Contrary to quality testing, unfavorable opinions about the quality of medications, together with other factors, lead to the use of more costly medications. The choice of medications and healthcare providers within the local health system was explained and influenced by trust in the system.²³ Similar to this, a different study carried out in South Africa revealed a pronounced discrepancy between opinions and the real quality of medications, pointing to shortcomings in government campaigns to raise awareness of generic drugs, which is influencing the use of generic prescribing.²⁴

Manufacturers' ads for their drugs have also been identified as a factor affecting prescription and dispensing patterns. According to a poll done in Ethiopia, 39.9% of doctors agreed or strongly agreed that their prescription practices will be influenced by drug makers' promotions and marketing.²⁵ One of the biggest obstacles to the adoption of generic prescription is undoubtedly the lack of awareness among medical and dental professionals as well as the unfavorable opinions of doctors toward generics.

The study results indicate a correlation between NAFLD and increasing age, with males being the most affected group. These findings are consistent with previous studies, including those by Toshihide¹⁴, James¹⁵, and Amedeo¹⁶, which have demonstrated a close association between age and the development of NAFLD. Additionally, the study aligns with research by Ylse¹⁷, which suggests that NAFLD prevalence is higher in postmenopausal

women and those with polycystic ovary syndrome (PCOS) compared to premenopausal women.

Moreover, it was observed that men under 55 years of age are more likely to develop NAFLD than women of the same age, with incidence rates increasing in women after menopause. This increase in incidence among postmenopausal women may be attributed to hormonal changes, particularly a decrease in estrogen levels after menopause. The dietary changes and elevated cholesterol levels, including high levels of low-density lipoprotein (LDL) in the blood, could rule as well¹⁸. Furthermore, women in menopause often experience weight gain with a redistribution of fat to visceral areas^{18,19}.

Based on BMI levels, the results showed significant differences ($P \leq 0.05$) between patients and healthy individuals, with patients exhibiting the highest ratio within the obese weight BMI category (90.0%). Whereas, healthy subjects predominantly fell within the normal weight BMI category and represented 70.0%. Both male and female patients had higher BMI levels compared to healthy individuals, with statistically significant differences ($P < 0.001$).

These findings are consistent with Fabbrini's work [20], in which a strong relationship between BMI and NAFLD was demonstrated. Obesity increases the risk of developing NAFLD due to an imbalance between fatty acid synthesis, oxidation, and excretion. High BMI levels can lead to metabolic disturbances, cardiovascular disease, and increased risk of mortality²¹.

According to our results, the mean waist circumference was higher for patients compared to controls, with significant differences ($P < 0.05$). These findings are consistent with those of Zheng²² and Cerbere²³, which demonstrated a close association between waist circumference and NAFLD. Additionally, the results are in good agreement with those of Bruno et al.²⁴, who found that postmenopausal females tend to have higher waist circumferences compared to males in the same age group. However, our findings are in contrast with Pinidiyapathirage's ones²⁵, who reported that men with NAFLD had higher waist circumferences compared to women. Furthermore, our results revealed a high increase in cholesterol levels ($P < 0.05$) in patients compared to healthy controls. This elevation could be attributed to LDL-cholesterol breakdown, facilitated by the activity of the cholesterol acyl transferase enzyme. In fact, this enzyme is stimulated by the absence of insulin, and resulting in an increase absorption of cholesterol in the intestines. Additionally, the consumption of meals

rich in saturated fats can contribute to elevated cholesterol levels in the body²⁶.

The deposition of increased cholesterol in blood vessels can lead to elevated blood pressure. Furthermore, cholesterol deposits with fatty substances may result in the formation of blood clots and arteriosclerosis due to the constriction of blood vessels and obstruction of blood flow²⁷. These factors increase the risk of severe heart disease²⁸. It is important to note that NAFLD is often associated with the increased mortality rate linked to heart and cardiovascular diseases²⁹. Therefore, the observed elevation in cholesterol levels in NAFLD patients underscores the importance of managing cholesterol levels as part of the comprehensive care for individuals with NAFLD. This mitigates the risk of cardiovascular complications and improves overall health outcomes. However, this result is consistent with the findings of Altparmak's study, in which patients with liver disease exhibit higher cholesterol levels compared to healthy individuals³⁰. Additionally, the results of Ho et al. revealed a direct relationship between increased cholesterol levels, portal phlebitis, and cirrhosis in NAFLD³¹. Furthermore, Enjoji et al. suggested treating patients with fatty liver disease by controlling dietary cholesterol intake³². Higher levels of triglycerides in patients were observed compared to healthy individuals, which lined with the results of the Leylabadlo and Kwon studies^{33,34}. Finally, Khamseh showed a high association between triglycerides and NAFLD³⁵. Here, all mentioned studies had similar findings to ours.

To investigate LDL, our results indicate a significant increase in the LDL level when the patient group is compared to healthy ones. These findings are consistent with those of Siddiqui and Tang studies, which demonstrated a significant elevation in LDL in patients compared to the control group^{36,37}. Furthermore, the results revealed a significant increase in VLDL levels in patients compared to controls. These findings align with those of Adiels et al.'s study, which showed a strong association between VLDL and NAFLD³⁸.

Regarding HDL levels, the mean values were non-significantly lower for patients compared to healthy individuals ($p > 0.05$). These results are in agreement with those found by Mirhafez studies, which demonstrated decreased HDL levels in individuals with fatty liver metabolism compared to healthy controls [39]. HDL plays a crucial role in transporting cholesterol from the body's cells to the liver, where it is purified and eliminated as waste. This process is beneficial for the body's overall health.

However, in contrast, our present research showed that the ALT and AST levels were significantly higher in the patient group compared to the healthy one,

suggesting a direct correlation between NAFLD and these variables ($p < 0.05$). Our results corroborate those of Francque and Younossi, who found that NAFLD patients had higher ALT levels^{40,41}. Prashanth et al. also discovered that steatohepatitis patients had higher ALT levels [42], and other research has shown that NAFLD patients have elevated AST levels^{43,44}.

Similarly, the ALP levels in patients of this investigation were relatively higher compared to healthy subjects with a small difference ($p > 0.05$). Thereby, these results are consistent with those of Bazick study, which showed an increase in ALP levels in patients with fatty liver and cirrhosis⁴⁵. Furthermore, a current study demonstrated that ALP was used as an independent biomarker for cirrhosis of the liver and NAFLD in obese individuals [46], which was also indicated in patients with steatohepatitis⁴².

The results of our study revealed a remarkable difference ($p < 0.05$) in levels of intelectin-1 between patients (1.10 ± 0.30 ng/mL) and the healthy group (0.41 ± 0.25 ng/mL). This could be an indicator of a relationship between NAFLD and the increase in intelectin-1 levels.

Yimaz et al. demonstrated similar findings suggesting that intelectin-1 serves as an independent indicator of hepatocyte hypertrophy⁴⁷. Another supporting evidence is the results of Eisinger et al.'s study, which showed high levels of intelectin-1 in cirrhotic liver patients⁴⁸. Hence, intelectin-1 levels may serve as a biomarker for NAFLD and could play a role in the pathophysiology of liver diseases.

5. CONCLUSION

Our findings demonstrate an increase in serum levels of intelectin-1 in patients with NAFLD. Intelectin-1 levels were significantly higher in NAFLD patients and exhibited the AUC and highest sensitivity in the ROC curve analysis. Furthermore, intelectin-1 showed a positive correlation with lipid profile and liver function parameters. Therefore, the elevation in plasma intelectin-1 levels, along with increased serum levels of total cholesterol, TG, LDL, VLDL, and liver function parameters, may serve as a potential indicator of liver insufficiency in NAFLD patients. Thereby, those can be utilized as predictors in the diagnosis of NAFLD.

DECLARATIONS

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None.

Conflict of Interest

The authors declare no known conflict for this work.

Ethical Approval

The study received ethical clearance from the Ethics Committee at the National Centre for Training and Human Development/Baquba Teaching Hospital of the Iraqi Health, as well as from the Ethical Committee at the University of Diyala. All participants provided written informed consent before taking part.

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