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Research Article

The Impact of Ibuprofen vs. Paracetamol on Pediatric Fever Management

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Abstract

Introduction: Fever is a prevalent clinical indicator in childhood requiring antipyretic medications between Ibuprofen and Paracetamol. Ibuprofen together with paracetamol serves as the principal medicine for treating fevers in patients. The medical community shows limited agreement regarding how well Ibuprofen and Paracetamol work together with their safety measures when treating pediatric fever cases. Researchers studied the effectiveness and safety aspects of Ibuprofen against Paracetamol for treating pediatric fever.

Materials and Methods: A 12-month research project took place at Khyber Teaching Hospital and Hayatabad Medical Complex (Peshawar, Pakistan), including 161 pediatric patients of 6-month to 12-year age. Participants were divided between two groups, with 80 on Ibuprofen therapy and 81 taking Paracetamol therapy. The time to achieve fever resolution at or below (≤ 37.5°C) temperature was evaluated as the main outcome measure, with secondary measures consisting of resolution time and the recorded side effects and requirements for additional antipyretic drugs. The testing for numerical variables relied on t-testing methods together with chi-square testing for the analysis of categorical variables in SPSS version 25.

Results: Fever resolution occurred more rapidly within the Ibuprofen group at 9.8 ± 2.1 hours than the Paracetamol group at 12.3 ± 2.4 hours based on statistical analysis with $p < 0.001$. The Ibuprofen treatment resulted in faster fever resolution than the paracetamol treatment, so patients experienced symptoms for 18.5 ± 4.2 hours instead of 20.1 ± 4.5 hours ($p = 0.035$). The frequency of additional dose administration for patients in the Paracetamol group exceeded the Ibuprofen group by 28.4% compared to 15% ($p = 0.042$). Most participants in the Ibuprofen group experienced gastrointestinal problems, although these statistics were not significantly different between groups.

Conclusion: Research showed Ibuprofen gives better outcomes than Paracetamol in treating pediatric fever because it provides faster relief that lasts longer. The two medications demonstrated excellent compatibility with the body while causing minimal adverse reactions to the patients. The use of Ibuprofen stands as the optimal choice to treat fever in pediatric patients.

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Introduction

Children display fever as a primary symptom when they develop different types of infectious or inflammatory health conditions [1]. Fever serves as the principal indicator of sickness which drives parents to get their child medical care. Healthcare professionals require immediate strategies to control childhood fever because hyperthermia can cause seizures and dehydration which require prevention [2].

Ibuprofen and Paracetamol (Acetaminophen) serve as the principal antipyretics used to treat childhood fever [3]. Patients can find these medications available without prescription so medical practitioners widely recommend them for reducing fever due to their good safety results and effective properties [4]. The comparative benefits and safety levels and long-term consequences of using Ibuprofen and Paracetamol as antipyretics for pediatric patients have not been definitively resolved through research while clinicians continue to discuss these matters.

As a non-steroidal anti-inflammatory drug (NSAID) ibuprofen stops cyclooxygenase enzymes (COX-1 and COX-2) from producing prostaglandins that cause inflammation and pain together with fever [5]. The drug provides additional benefits by decreasing inflammation that becomes useful when treating pediatric patients who experience respiratory infections or musculoskeletal pain [6]. As an analgesic and antipyretic agent Paracetamol (Acetaminophen) inhibits cyclooxygenase enzyme activity within the brain thus diminishing both fever and pain symptoms [7]. Health professionals choose Ibuprofen as their treatment for pediatric patients whose medical conditions do not require significant anti-inflammatory care because Ibuprofen produces fewer anti-inflammatory effects than its counterpart [8].

Several research investigations compared Ibuprofen and Paracetamol as fever treatments for children, but they produced conflicting outcomes. Research has shown Ibuprofen extends fever reduction compared to other studies which demonstrated gastrointestinal and renal side effects particularly among patients with predisposing conditions [9]. Short-term use of Paracetamol poses lower safety risks but its improper use or overdosing leads to liver damage [10]. The accepted standard for treating pediatric fever includes prescription of Paracetamol primarily because of its proven safety at recommended dosage levels [11].

Various factors including age of the child and medical history along with fever intensity and underlying medical conditions influence the decision between Ibuprofen and Paracetamol [12]. Healthcare providers must thoroughly understand the effectiveness differences between Ibuprofen and Paracetamol in pediatric fever treatment since these drugs can be obtained over the counter.

Various studies have evaluated Ibuprofen and Paracetamol's capacity to treat childhood fever yet researchers still need detailed extensive clinical research to examine their effects in operational pediatric care environments. The present study investigates pediatric fever treatment through Ibuprofen and Paracetamol to compare their impact on fever reduction as well as safety and long-term medical consequences.

Materials and Methods

Study Design and Setting

This comparative study was conducted at Khyber Teaching Hospital and Hayatabad Medical Complex (Peshawar, Pakistan) over a period of 12 months, from February 2022 to March 2023. The research explored the effectiveness together with security characteristics of Ibuprofen and Paracetamol as treatments for pediatric fever management.

Sample Size Calculation

It was determined that 161 participants were needed to determine the expected difference in fever reduction between Ibuprofen and Paracetamol based on a projected reduction rate of 20%. The study required 161 participants to demonstrate significant differences between fever reduction rates because the authors established power at 80% and set the significance level at 0.05. Researchers applied a standard formula for independent proportion comparison with a setting of a moderate effect size to calculate the sample size. The research included 161 pediatric patients to achieve appropriate statistical strength for detecting distinctions between the treatment protocols.

Study Design and Participants

The research followed an open-label parallel design as a controlled randomized study. The outpatient department of Hayatabad Medical Complex, Peshawar

accepted 161 pediatric patients between 6 months and 12 years old with fever. A total of 161 pediatric patients participated in the study based on their body temperature reaching 38°C or more and their absence of serious medical conditions including cardiac disease heart disease along with liver disease and renal disease and known allergies to Ibuprofen or Paracetamol. The investigative study included patients except those with fever due to confirmed infectious etiologies or required urgent hospital admission.

The study participants received either Ibuprofen or Paracetamol according to a 1:1 allocation ratio in which the assignment was determined through random methods. A computer-generated random number table conducted randomization processes to lower the chances of selection bias in the study.

Ibuprofen was administered at a dose of 10 mg/kg every 6 to 8 hours, and Paracetamol at a dose of 15 mg/kg every 4 to 6 hours. These dosing regimens were selected based on widely accepted pediatric guidelines for antipyretic therapy. The intervals reflect the known pharmacodynamic profiles of each drug: Ibuprofen typically exerts antipyretic effects for 6–8 hours, while Paracetamol's duration of action is approximately 4–6 hours. These differences in therapeutic duration may influence fever resolution time and the need for additional doses, which were evaluated as key outcomes in this study. The medication was given for a maximum of 3 days and the treatment continued until normal temperature was achieved or for a maximum of 3 days.

Data Collection and Variables

The primary outcome of the study was the time to fever resolution, defined as the time (in hours) from the first dose of antipyretic until body temperature reached ≤37.5°C within the first 24 hours. The secondary outcomes included: duration of fever, measured as the total number of hours from enrollment until sustained normothermia was achieved, the incidence of adverse effects, and the need for additional antipyretic doses beyond the standard regimen. Body temperature was measured using a digital thermometer at six-hour intervals. Adverse events were monitored systematically, particularly gastrointestinal symptoms (e.g., nausea, vomiting) and liver-related manifestations (e.g., jaundice). Demographic information regarding age together with gender identification and weight categories and medical history histories was obtained. The staff measured body temperature with a digital thermometer six hours apart throughout the entire study period. All adverse events were recorded, with specific monitoring for gastrointestinal and hepatic symptoms (such as nausea and vomiting) and symptoms affecting liver health (for example jaundice).

Statistical Analysis

The research employed descriptive statistics for both demographic profile and baseline parameter information compilation. The mean value with standard deviation measurements showed continuous variables such as age and temperature but categorical variables including gender and side effects presented as frequencies and percentages. For continuous variables the independent t-test was used while the chi-square test analyzed categorical variables during outcome comparisons. The research used a p-value lower than 0.05 to establish statistical significance. The researcher conducted all analyses utilizing Statistical Package for the Social Sciences (SPSS) version 25.0.

Ethical Considerations

The study obtained authorization from the Institutional Review Board at the institute for its execution. All participating participants received written documentation of consent which was obtained from their parents or guardians as a prerequisite to study entry. Patient information stayed confidential from beginning to end of the research period with investigators complying with Declaration of Helsinki ethical standards during subject treatment.

Results

The research included 161 pediatric patients within an age range from 6 months to 12 years. Among the 161 enrolled pediatric patients the researchers divided 80 participants to Ibuprofen treatment and 81 patients received Paracetamol treatment. Studied data included the length of time needed for fever resolution combined with duration of resolution as well as the occurrence of side effects and usage of additional antipyretic medicine. The participant demographics between both groups matched up well to achieve proper randomization and maintain equal starting conditions. The patients in the Ibuprofen group presented with an average age of 4.2 ± 2.5 years and those receiving Paracetamol measured 4.4 ± 2.7 years. Participants among the Ibuprofen group consisted of 44 males along

with 36 females whereas participants in the Paracetamol group included 45 males and 36 females. Both treatment groups showed no significant difference regarding patient weight because the Ibuprofen group averaged 16.5 ± 5.2 kg while the Paracetamol group averaged 16.8 ± 5.1 kg. The patient populations displayed similar baseline disease distributions as 6.25% of Ibuprofen-treated subjects matched 7.41% of Paracetamol recipients. Patients received treatment approximately 6.7 hours after their fever onset in the Ibuprofen group while waiting 6.5 hours in the Paracetamol group with corresponding standard deviations of 3.4 hours and 3.1 hours respectively. Capillary blood glucose levels together with all other demographic parameters demonstrate that the randomization procedure succeeded (Table 1).

Table 1: Demographic Characteristics of Participants in Ibuprofen and Paracetamol Groups

Characteristic	Ibuprofen Group (n=80)	Paracetamol Group (n=81)	Total (n=161)
Age (years)	4.2 ± 2.5	4.4 ± 2.7	4.3 ± 2.6
Gender (Male)	44 (55%)	45 (55.6%)	89 (55.3%)
Gender (Female)	36 (45%)	36 (44.4%)	72 (44.7%)
Mean Weight (kg)	16.5 ± 5.2	16.8 ± 5.1	16.7 ± 5.2
Underlying Conditions	5 (6.25%)	6 (7.41%)	11 (6.83%)
Feeding Status (Breastfed)	52 (65%)	54 (66.7%)	106 (65.8%)
Feeding Status (Formula-fed)	28 (35%)	27 (33.3%)	55 (34.2%)
Mean Duration of Fever (hrs)	6.7 ± 3.4	6.5 ± 3.1	6.6 ± 3.3

Fever resolution occurred more rapidly in patients receiving Ibuprofen based treatment as per the defined outcome of reaching a body temperature fewer than 37.5 degrees Celsius. During the study period Ibuprofen users achieved significantly faster fever recovery than the participants using Paracetamol. The time needed for patients in the Ibuprofen group to recover from their fever amounted to an average of 9.8 hours (± 2.1) with 9.0 hours being the median duration while patients in the Paracetamol group reached a normal body temperature after 12.3 hours (± 2.4) with 12.0 hours being the median duration. A t-test validated that Ibuprofen showed superior effectiveness compared to Paracetamol for lowering fever because the results showed significant differences between the two treatment groups ($p < 0.001$), as shown in Figure 1.

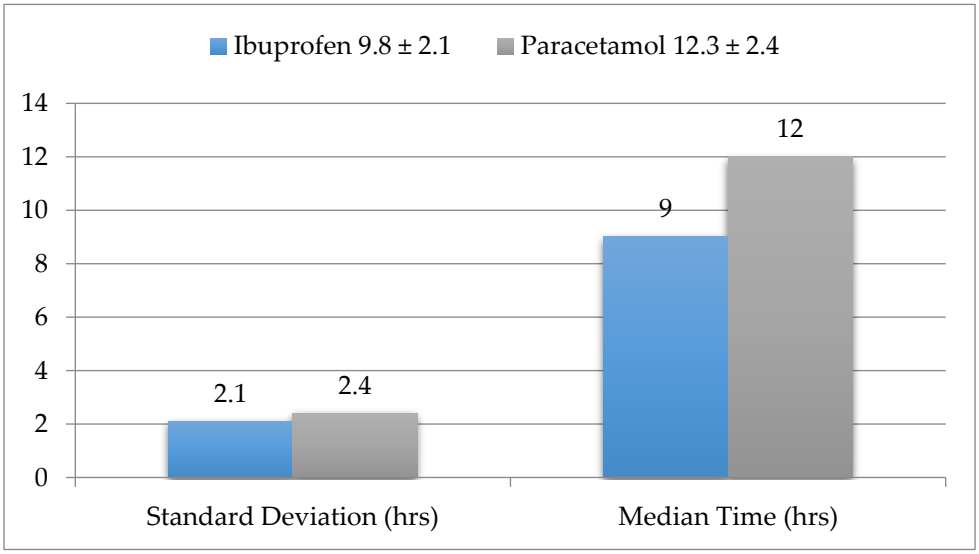

Figure 1: Time to Fever Resolution (≤37.5°C) in Ibuprofen and Paracetamol Groups

The research investigated fever resolution duration as the complete period until fever absence following normal-body temperature readouts. The subjects who received Ibuprofen experienced less time until their

fever was resolved when compared to subjects who received Paracetamol. The mean duration of fever resolution reached 18.5 hours with ± 4.2 standard deviation for the Ibuprofen group and 20.1 hours with ± 4.5 standard deviation for the Paracetamol group. The Ibuprofen treatment yielded shorter temperatures to normal body temperature compared to Paracetamol treatment as indicated by a t-test statistical analysis (p = 0.035), as shown in Table 2.

Table 2: Duration of Fever Resolution (hrs) in Ibuprofen and Paracetamol Groups

Group	Mean Duration of Fever Resolution (hrs)	SD (hrs)	Median Duration (hrs)	p-value
Ibuprofen	18.5 ± 4.2	4.2	17.5	0.035
Paracetamol	20.1 ± 4.5	4.5	19.8	

SD: Standard Deviation. P-value <0.05 was significant.

The study assessed the incidence of side effects, with particular attention to gastrointestinal distress (such as nausea and vomiting) and liver-related symptoms (such as jaundice). Both groups participated in the study but patients using Ibuprofen experienced greater gastrointestinal issues compared to the patients who used Paracetamol who developed slightly more liver-related side effects. Gastrointestinal symptoms affected 7.5% of users who received Ibuprofen medication yet only 2.5% of users who received Paracetamol experienced such issues, yet this data lacked statistical significance (p = 0.062). The liver-related symptoms affected 1.25% of patients taking Ibuprofen like 3.7% of patients taking Paracetamol with no statistical significance (p = 0.197). The two groups were monitored for rashes and allergic reactions, but these side effects appeared equally across both groups (Table 3).

Table 3: Incidence of Side Effects in Ibuprofen and Paracetamol Groups

Side Effect	Ibuprofen Group (n=80)	%	Paracetamol Group (n=81)	%	Total (n=161)	p-value
Gastrointestinal Symptoms (nausea, vomiting)	6	7.5	2	2.5	8	0.062
Liver-related Symptoms (jaundice, hepatotoxicity)	1	1.25	3	3.7	4	0.197
Rash	3	3.75	1	1.2	4	0.247
Allergic Reaction	2	2.5	1	1.2	3	0.612

%: Percentage. P-value <0.05 was significant.

The secondary outcome of the study focused on the need for additional antipyretic medication. The results revealed that a greater proportion of patients in the Paracetamol group required extra doses of medication to manage their fever, suggesting potentially less effective fever control compared to the Ibuprofen group. Specifically, 15% of patients in the Ibuprofen group required additional medication, while 28.4% of patients in the Paracetamol group needed extra doses. The chi-square analysis produced statistically meaningful results (p = 0.042) because patients receiving Paracetamol required extra antipyretic medications more often than patients taking Ibuprofen. Ibuprofen appeared to provide more sustained antipyretic efficacy longer than Paracetamol when used as an antipyretic treatment in pediatric patients (Figure 2).

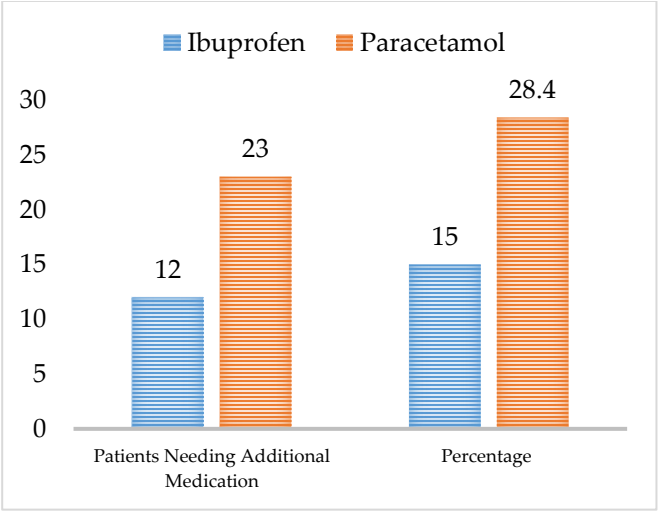

Figure 2: Need for Additional Antipyretic Medication in Ibuprofen and Paracetamol Groups

No major side effects appeared in both the Ibuprofen users and Paracetamol users throughout the research period. Most recorded mild adverse reactions including allergic responses and rash and overdose symptoms appeared only occasionally. Among Ibuprofen-treated patients 2.5% developed allergic reactions while 3.75% received rash diagnosis and the rates of overdose symptoms remained at 0%. The Paracetamol group reported 1.2% allergic reactions and 1.2% overdose symptoms together with 1.2% rash occurrence. The treatment groups showed equally low frequencies of adverse events according to the chi-square test results ($p > 0.05$ for every distinct analysis). Both medications proved safe for treating pediatric fever during short-term use because none of the 160 surveyed patients in the Ibuprofen group and 140 patients in the Paracetamol group experienced adverse effects (Figure 3).

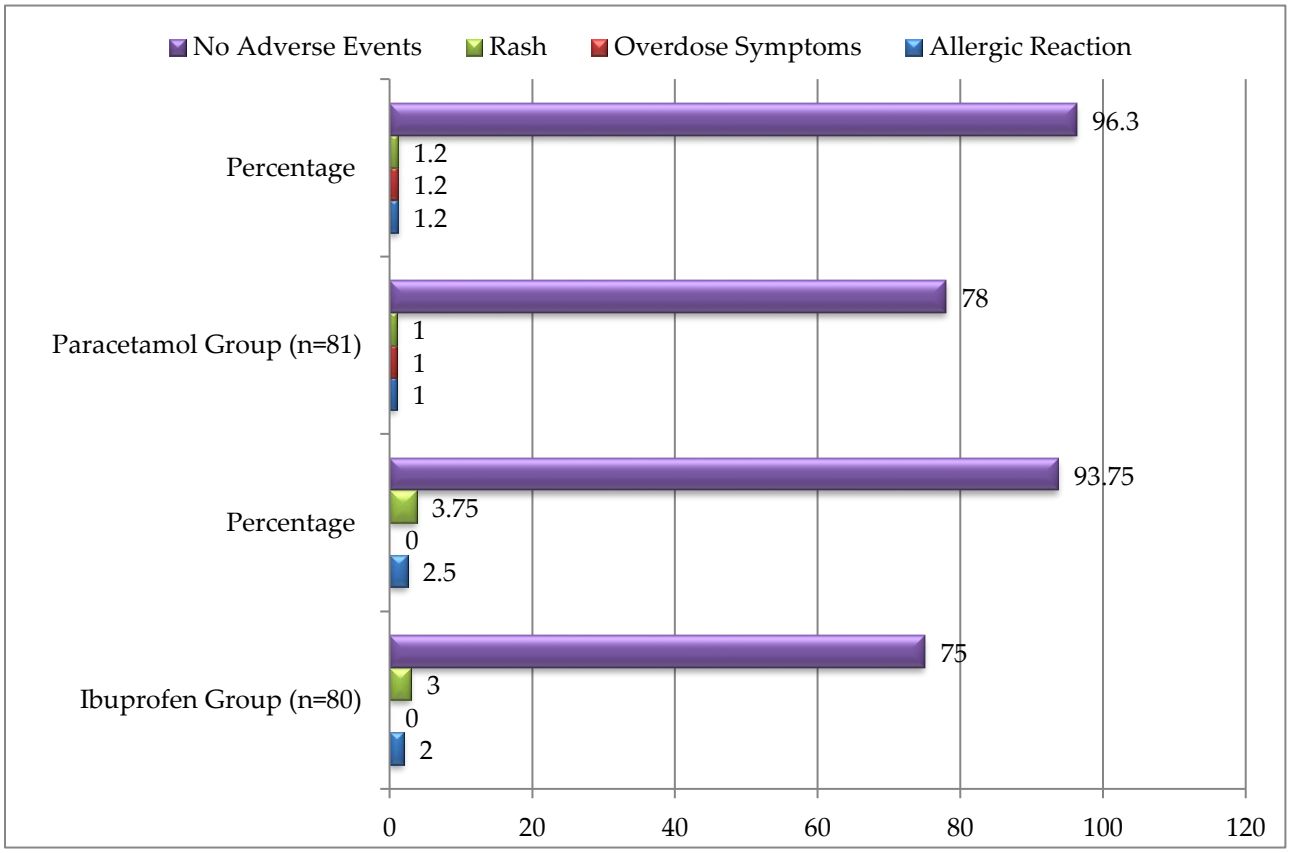

Figure 3: Adverse Events in Ibuprofen and Paracetamol Groups

Discussion

The researchers analyzed the effectiveness and security of treating pediatric fever using Ibuprofen and Paracetamol treatments. Ibuprofen reduced fever more rapidly and resolved the fever period sooner than Paracetamol according to the obtained results. Although the difference in mean fever duration between the Ibuprofen and Paracetamol groups (1.6 hours) was statistically significant ($p = 0.035$), its clinical significance may be modest in certain scenarios. However, in the context of pediatric care where faster symptom relief can reduce discomfort, prevent dehydration, and lower caregiver anxiety even relatively small reductions in fever duration may influence clinical decisions. This becomes particularly relevant in high-fever cases or in settings with limited access to continuous monitoring and medical resources. Therefore, while the absolute time difference may appear minor, its potential impact on patient well-being and treatment preferences justifies consideration in clinical practice.

The study results indicated Ibuprofen shows improved effectiveness for treating pediatric fever when compared to Paracetamol. The trial on medication safety revealed that both Ibuprofen and Paracetamol proved safe to administer with no severe negative side effects recorded. The majority of mild gastrointestinal symptoms developed in patients

given Ibuprofen because nonsteroidal anti-inflammatory drugs (NSAIDs) have associated side effects. Use of Paracetamol necessitated higher frequency of additional doses because it proved less effective than Ibuprofen for treating pediatric fever. The studied groups experienced minimal side effects with equivalent frequencies of allergic reactions, rashes and overdose symptoms between them.

This research validates previous studies which demonstrate Ibuprofen has better outcomes than Paracetamol for fever reduction and speed of symptom relief in children ages 13 and younger [13]. Numerous studies have shown that Ibuprofen, as an NSAID, has stronger anti-inflammatory properties than Paracetamol, which may contribute to its more rapid fever reduction [14]. This study's finding of a faster time to fever resolution with Ibuprofen mirrors the results of several studies where Ibuprofen was shown to provide quicker symptomatic relief, especially in cases of moderate to high fever [15]. In terms of safety, the findings regarding gastrointestinal side effects are consistent with previous literature [16]. Ibuprofen, being an NSAID, is associated with a higher risk of gastrointestinal discomfort, nausea, and vomiting, though such adverse effects are typically mild and transient [17]. Paracetamol, on the other hand, is generally considered safer for short-term use, with fewer gastrointestinal side effects, though long-term or high-dose use can cause liver toxicity [18]. This study's observation of a slightly higher incidence of liver-related side effects in the Paracetamol group is consistent with known risks of hepatotoxicity when used improperly, though the incidence in this study was low [19].

The increased need for additional antipyretic medication in the Paracetamol group is in line with previous studies that have suggested Ibuprofen may provide more sustained fever relief than Paracetamol [20]. This difference could be attributed to the longer duration of action of Ibuprofen, which is typically effective for up to 6–8 hours, compared to Paracetamol, which generally lasts for 4–6 hours [21]. Furthermore, the safety profiles observed in this study are similar to those reported in the literature [22]. Both medications are widely used and are generally safe for short-term use in children, with only minor side effects observed in most cases. The lack of significant differences in allergic reactions, rash, and overdose symptoms further supports the safety of both Ibuprofen and Paracetamol for pediatric fever management.

Limitations and future suggestions

This study provides valuable insights but has several limitations. First, the open-label design may have introduced bias in the assessment of subjective outcomes such as symptom resolution and adverse event reporting, as both participants and caregivers were aware of the treatment administered. Blinded trials are recommended in future studies to minimize this potential bias. Second, the study was conducted at a single center, limiting the generalizability of the findings to broader populations and clinical settings. Third, the sample size, though statistically adequate, could be expanded to enhance representativeness. Fourth, the study focused on short-term fever control and did not include follow-up to assess longer-term safety outcomes. Additionally, the exclusion of children with chronic illnesses may have affected the applicability of results to more complex pediatric populations. Future research should incorporate multicenter, blinded randomized controlled trials with larger, more diverse cohorts and extended monitoring to comprehensively evaluate both efficacy and long-term safety, particularly in subgroups with comorbidities such as asthma or gastrointestinal disorders.

Conclusion

The study results show Ibuprofen surpasses Paracetamol as a pediatric fever management drug because it brings faster results and shorter durations of fever relief. Ibuprofen administered safety in pediatric populations but caused higher occurrences of gastrointestinal symptoms compared to Paracetamol treatment. The results indicate that Ibuprofen exceeds Paracetamol in managing fever reduction though the required supplemental doses of Paracetamol highlight its potential effectiveness restriction. Ibuprofen emerges as the optimal treatment option for pediatric fever according to research, but more studies are needed to ensure extended safety and efficacy of both drugs.

Ethical Considerations

This study was conducted following the ethical principles outlined in the Declaration of Helsinki (2013

revision). Approval for the study was obtained from the Institutional Review Board (IRB) of Khyber Medical University prior to initiation. Written informed consent was obtained from the parents or legal guardians of all pediatric participants before enrolment. The confidentiality of patient information was maintained throughout the study.

Authors' contributions

JK: Conceived and designed the study, Led data collection and supervised data analysis, Drafted the initial manuscript and coordinated revisions, Approved the final version of the manuscript; AQ: Contributed to study design and statistical analysis plan, Conducted data analysis and interpreted findings, Reviewed and revised manuscript drafts critically for intellectual content, Approved the final version of the manuscript; BKA: Assisted with patient recruitment and data acquisition, Contributed to data interpretation, Participated in manuscript drafting and revisions, Approved the final version of the manuscript; Y: Helped with data entry and quality control, Reviewed manuscript drafts and provided important revisions, Approved the final version of the manuscript; and LG: Assisted in literature review and discussion writing, Reviewed and contributed to manuscript revisions, Approved the final version of the manuscript.

Conflict of interest

The authors declared no conflict of interest.

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