

# Pharmacoeconomic Evaluation and Clinical Outcome of the Use of Channa Products as an Adjuvant in Human Albumin Therapy 20% in Ileus Patients: A Cost-Effectiveness Analysis (CEA) at Imelda Pekerja Indonesia Hospital

Alex Handani Sinaga<sup>1</sup>, Milda Yanti<sup>2</sup>, Guntur Berlian<sup>3</sup>, Asep Aripin<sup>4</sup>

<sup>1,2</sup> Program Studi Sarjana Farmasi, Universitas Imelda Medan, Medan, Indonesia

<sup>3,4</sup> Mega Medica Pharmaceuticals, Kalideres, Jakarta Barat, Indonesia

Email: Alex.sinaga25@gmail.com

Hypoalbuminemia is a complication that is often found in ileus patients and is associated with an increased risk of complications, length of hospitalization, and the burden of treatment costs. Human albumin therapy is effective but high-cost, so pharmacoeconomic studies are needed on alternative therapies based on snakehead fish extract (*Channa striata*). This study aims to evaluate the cost-effectiveness and clinical outcomes of the use of Channa products as an adjuvant in 20% Human Albumin therapy in ileus patients with hypoalbuminemia at Imelda Pekerja Indonesia Hospital Medan. The study used an observational analytical design with retrospective data collection of 49 patients who were grouped into three therapy groups: Channa single, Human Albumin 20% single, and a combination of both. Effectiveness is measured using length of stay (LOS) as a proxy for therapy success, while cost is calculated from the direct cost of treatment. Cost effectiveness analysis was carried out through the calculation of Average Cost-Effectiveness Ratio (ACER) and Incremental Cost-Effectiveness Ratio (ICER). The results showed the lowest average direct cost in the single Channa group (IDR 10,155,201) and the highest in the single 20% Human Albumin (IDR 39,806,166). The lowest ACER value was for the single Channa group (Rp 1,846,400 per day of treatment), and in the ICER calculation, the combination group was dominant over the 20% single Human Albumin and the single Channa group was dominant against the other two groups. It was concluded that Channa-based therapy is the most cost-effective option for the correction of hypoalbuminemia in ileus patients, while Human Albumin 20% remains important in severe conditions that require rapid correction prior to surgical procedures.

**Keywords:** *Channa striata*; cost-effectiveness analysis; farmakoekonomi; hypoalbuminemia; human albumin; ileus.

This is an open access article under the [CC BY-NC](#) license.



## Corresponding Author:

Alex Handani Sinaga

Program Studi Sarjana Farmasi, Universitas Imelda Medan

Alex.sinaga25@gmail.com

## 1. Introduction

Albumin is the plasma protein with the highest concentration in the blood that plays an important role in maintaining colloidal osmotic pressure, transporting various substances in the body, and supporting the tissue healing process. When serum albumin levels drop below normal values, the body experiences hypoalbuminemia which is often found in inpatients, especially in acute and chronic disease conditions [1]. Globally, the incidence rate of hypoalbuminemia is relatively high; A study of 1,071 patients in one hospital in India showed a prevalence of 15%, and this condition is mostly found in surgical patients as well as abdominal emergencies [2].

Ileus, both obstructive and paralytic, is one of the cases of abdominal emergencies that are often accompanied by hypoalbuminemia due to impaired absorption, protein loss, and systemic inflammatory responses. The results of observation of medical record data at Imelda Pekerja Indonesia Hospital in Medan

Pharmacoeconomic Evaluation and Clinical Outcome of the Use of Channa Products as an Adjuvant in Human Albumin Therapy 20% in Ileus Patients: A Cost-Effectiveness Analysis (CEA) at Imelda Pekerja Indonesia Hospital.

Alex Handani Sinaga et.al

show that ileus is one of the most diagnoses that have the potential to be accompanied by hypoalbuminemia, thus making it a relevant group of patients to be studied [3]. In ileus patients, hypoalbuminemia is closely associated with an increased risk of postoperative complications and prolonged length of hospitalization.

In clinical practice, the most commonly used therapy to increase albumin levels quickly is the administration of human albumin. Although effective, human albumin is known to be high cost, so it is a consideration in health financing [4]. As an effort to complement therapy, snakehead fish extract (*Channa striata*) is often researched because it contains high protein, albumin fractions, and essential amino acids that play a role in protein synthesis and tissue regeneration, so it has the potential to be positioned as an adjuvant therapy that accompanies the administration of human albumin [5]. The research gap found is that there are still limited studies that directly compare the cost-effectiveness between human albumin alone and a combination of human albumin and *Channa* in ileus patients with hypoalbuminemia.

To answer this need, the pharmacoeconomic evaluation method chosen is Cost-Effectiveness Analysis (CEA), because the therapies being compared have the same goal, namely to improve the clinical condition of patients with different amounts of cost and effectiveness [6]. The clinical outcomes used were length of stay as a proxy for the success of therapy, and the results of CEA were manifested in the form of ACER and ICER [7]. This study aims to evaluate the pharmacoeconomic aspects and clinical outcomes of the use of *Channa* products as an adjuvant in 20% Human Albumin therapy in ileus patients with hypoalbuminemia at the Imelda Pekerja Indonesia Hospital in Medan, so that rational, effective, and economical therapy options can be determined.

## 2. Literature Review and Problem Formulation

Ileus is a disorder of the intestinal passage, both due to mechanical blockage (obstructive ileus) and motility disorder (paralytic ileus), which can cause abdominal emergencies and require immediate treatment. In ileus patients, hypoalbuminemia occurs due to a combination of absorption disorders, protein loss, and systemic inflammation. Decreased albumin levels lower plasma oncotic pressure, slow tissue healing, and are a strong indicator of increased risk of postoperative complications [1].

Management of hypoalbuminemia includes pharmacological and non-pharmacological therapies. Human Albumin 20% is a hyperoncotic colloidal solution that is administered intravenously for rapid correction, while *Channa striata* acts as an oral adjuvant therapy that increases endogenous albumin synthesis in the liver through the provision of amino acids and decreased inflammation [8]. Pharmacoeconomics is an important instrument in supporting quality control and control of medical costs in the era of National Health Insurance, with CEA as a method that compares the cost of an intervention with its health outcomes in non-monetary units [6].

Several previous studies have highlighted the pharmacoeconomic aspects of albumin therapy. Wahyuningtiyas et al. (2020) analyzed the effectiveness and cost of pure snakehead fish extract compared to 20% Human Albumin and concluded that snakehead fish extract is expected to have equivalent effectiveness at a lower cost [9]. Witha et al. (2024) compared human albumin products in postoperative patients and found the need to consider cost-effectiveness in the selection of therapies [10]. However, most studies still focus on comparisons between albumin products and not many have evaluated the cost-effectiveness of albumin when combined with *Channa striata*-based adjuvants in ileus patients.

Based on these gaps, three problems were formulated: (1) how to describe the characteristics of ileus patients with hypoalbuminemia who underwent albumin therapy; (2) how much is the direct cost of therapy

in each therapy group; and (3) what is the value of ACER and ICER for each therapy group so that the most cost-effective therapy for the correction of hypoalbuminemia in ileus patients at the Imelda Pekerja Indonesia Hospital in Medan can be determined.

### 3. Method

This study is a pharmacoeconomic study with an observational analytical design and a Cost-Effectiveness Analysis (CEA) approach. Data were collected retrospectively from the details of inpatient care transactions (billing) as well as the medical records of ileus patients with hypoalbuminemia at the Imelda Pekerja Indonesia Hospital in Medan [11]. The study subjects were 49 patients who met the inclusion criteria, namely ileus patients with hypoalbuminemia who received 20% Human Albumin therapy, snakehead fish extract (*Channa striata*), or a combination of both, and had complete medical record and billing data. Patients with incomplete data are excluded.

Patients were grouped into three therapy groups: (1) single Channa, (2) 20% Human Albumin single, and (3) 20% Human Albumin + Channa combination. The free variable is the direct cost component during treatment which includes room costs, intensive care, BMHP, nursing, consultations, surgical procedures, medical devices, and medications, while the bound variable is the type of therapy that is assessed from effectiveness. Given the limited numerical value data on albumin levels in the billing file, therapy effectiveness was measured using length of stay (LOS) as a proxy for therapy success, where shorter LOS showed better outcomes [7]. Cost effectiveness analysis was carried out by calculating the Average Cost-Effectiveness Ratio (ACER = average cost ÷ average LOS) and Incremental Cost-Effectiveness Ratio (ICER = cost difference ÷ difference between groups). Alternative therapies with the lowest ACER value are considered the most cost-effective.

### 4. Results and Discussion

This study analyzed 49 ileus patients with hypoalbuminemia who underwent hospitalization. Patient characteristics, length of hospitalization, direct cost of therapy, and the results of pharmacoeconomic analyses (ACER and ICER) are described as follows.

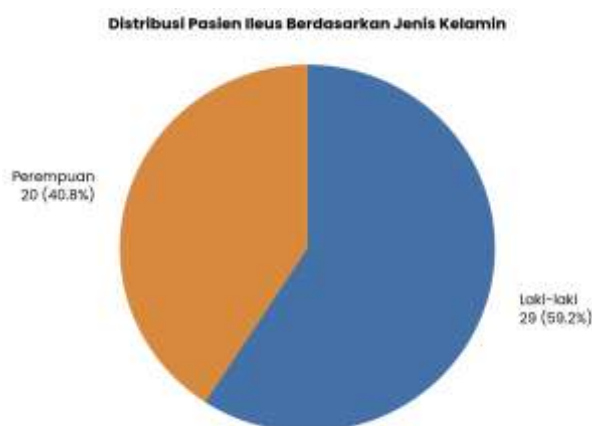
#### Patient Characteristics

Patient characteristics included gender, age, underwriter, comorbidities, length of hospitalization, and albumin therapy group received. A summary of the distribution of characteristics is presented in Table 1.

**Table 1.** Distribution of Ileus Patients with Hypoalbuminemia

| No. | Characteristics           | Category                   | Number | Percentage (%) |
|-----|---------------------------|----------------------------|--------|----------------|
| 1   | Gender                    | Male                       | 29     | 59.2           |
|     |                           | Female                     | 20     | 40.8           |
| 2   | Age                       | 0–1 year (infant)          | 22     | 44.9           |
|     |                           | 1–5 years                  | 5      | 10.2           |
|     |                           | 6–11 years                 | 4      | 8.2            |
|     |                           | 12–17 years                | 7      | 14.3           |
|     |                           | 18–59 years                | 6      | 12.2           |
|     |                           | ≥60 years                  | 5      | 10.2           |
| 3   | Therapy Group             | Channa (single therapy)    | 2      | 4.2            |
|     |                           | Human Albumin 20%          | 33     | 68.8           |
|     |                           | Channa + Human Albumin 20% | 13     | 27.1           |
| 4   | Health Insurance Provider | BPJS Kesehatan             | 49     | 100            |

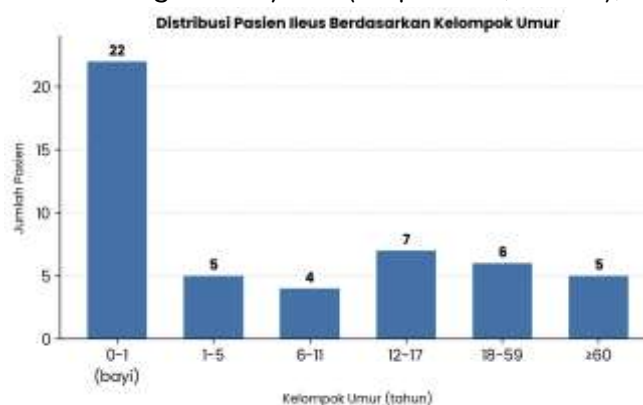
Based on Table 1, the study population was dominated by male patients (29 patients; 59.2%), infant age group 0–1 year (22 patients; 44.9%), and all of them were BPJS Kesehatan participants (100%), so the aspects of efficiency and rationality of therapy costs are very relevant to be studied. The distribution by sex is shown in Figure 1.



**Figure 1.** Distribution of Ileus Patients by Gender

The higher proportion of men is in line with the epidemiological pattern of the ileus, where the incidence of obstructive and paralytic ileus tends to be more common in men, among others due to the high incidence of inguinal hernia and postoperative abdominal adhesion. In the infant population that dominated the study, congenital gastrointestinal disorders such as atresia and Hirschsprung's disease were also more common in male infants [12].

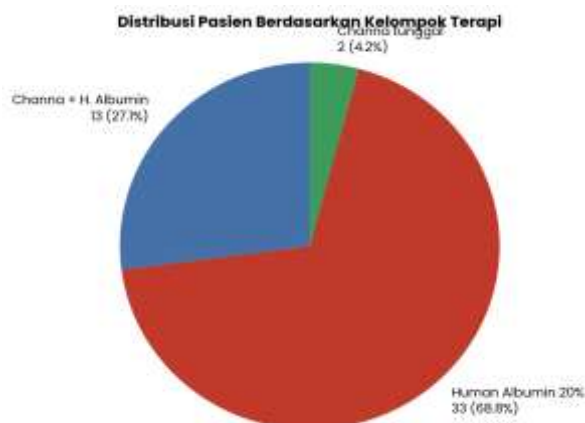
By age, the largest group was infants aged 0–1 years (22 patients; 44.9%), as presented in Figure 2.



**Figure 2.** Distribution of Ileus Patients by Age Group

The dominance of infant patients reflects the high incidence of ileus in the neonatal and infantile periods, which are generally related to congenital disorders of the gastrointestinal tract such as intestinal atresia, Hirschsprung disease, and necrotizing enterocolitis. The condition of hypoalbuminemia in the infant group is aggravated by immaturity of liver function in synthesizing albumin and high metabolic needs during the growth period.

Based on the therapy group, the majority of patients received 20% single Human Albumin (33 patients; 68.8%), followed by a combination of Channa + Human Albumin 20% (13 patients; 27.1%) and single Channa (2 patients; 4.2%), as shown in Figure 3.



**Figure 3.** Distribution of Patients by Therapy Group

The dominance of the use of Human Albumin of 20% reflects the clinical condition of ileus patients with hypoalbuminemia which generally requires rapid albumin correction, especially in patients who are about to undergo surgical procedures or are in critical condition. Meanwhile, the use of Channa both alone and as an adjuvant is still relatively limited, illustrating its position as an oral supplementation therapy. Almost all patients are BPJS Kesehatan participants, so the aspect of therapy cost efficiency is very relevant.

Comorbidities beyond hypoalbuminemia were analyzed to describe the clinical complexity of the patient, as presented in Figure 4.

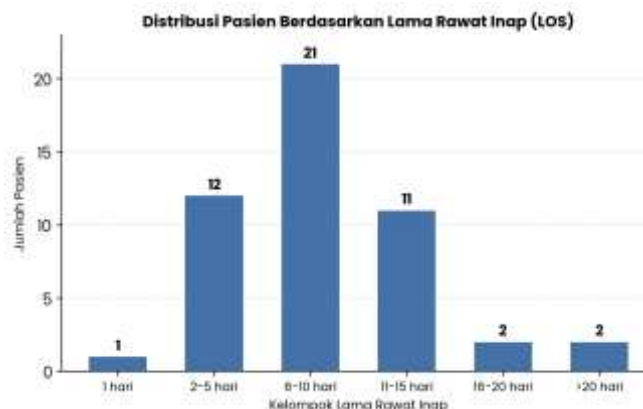


**Figure 4.** Frequency of Comorbidities in Ileus Patients with Hypoalbuminemia

Of the 49 ileus patients, 13 patients (26.5%) had hypoalbuminemia without dominant comorbidities, while the most frequent comorbidities were anemia (9 patients; 18.4%), sepsis (8 patients; 16.3%), metabolic acidosis (7 patients; 14.3%), pulmonary/pleural disorders (6 patients; 12.2%), peritonitis (4 patients; 8.2%), and hypoglycemia (2 patients; 4.1%). High comorbidities of anemia are a common finding in ileus patients with hypoalbuminemia, as both reflect impaired nutritional status and systemic inflammation [13]. This large number of infectious and metabolic comorbidities aggravates the inflammatory status and accelerates the decline in albumin levels, thus confirming the character of ileus patients as a multicomplex population.

### Length of Stay Analysis

Length of stay (LOS) is used as an indicator of clinical outcomes as well as a measure of therapy effectiveness. The distribution of patients by length of stay is presented in Figure 5.



**Figure 5.** Distribution of Patients Based on Length of Stay (LOS)

The largest group of treatment was 6–10 days (21 patients; 42.9%), followed by 2–5 days (12 patients; 24.5%) and 11–15 days (11 patients; 22.4%). The length of stay ranges from 1 to 24 days with an average of 8.7 days. This variation in length of care reflects the diversity of patients' clinical severity, where patients with more severe conditions and complications tend to require longer treatment.

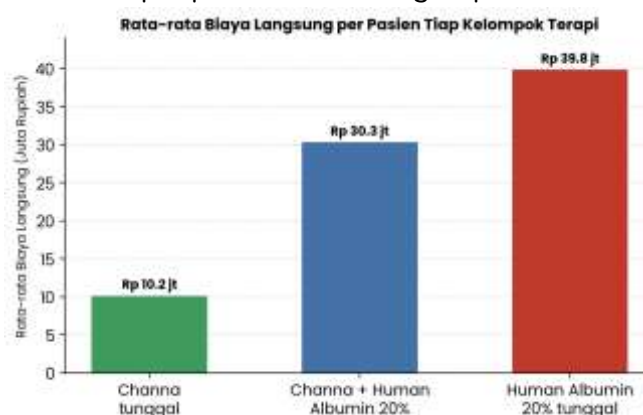
### Direct Cost Analysis of Therapy

The analyzed direct costs include eight components of service costs (room, intensive care, BMHP, nursing, consultation, surgical procedures, medical equipment, and medicines) as well as total direct costs equivalent to the total billing bill. A summary of the average direct cost and length of treatment per therapy group is presented in Table 2.

**Table 2.** Summary of Average Direct Costs and Length of Care per Therapy Group

| Therapy Group              | n  | Average Cost/Patient (IDR) | Average LOS (days) |
|----------------------------|----|----------------------------|--------------------|
| Channa (single therapy)    | 2  | 10.155.201                 | 5,5                |
| Human Albumin 20%          | 33 | 39.806.166                 | 9,0                |
| Human Albumin 20% + Channa | 13 | 30.288.421                 | 8,5                |

The cost details show that the single Channa group has a total direct cost of IDR 20,310,402 (average IDR 10,155,201/patient), the single 20% Human Albumin group IDR 1,313,603,470 (average IDR 39,806,166/patient), and the combination group IDR 393,749,469 (average IDR 30,288,421/patient). The comparison of the average direct cost per patient between groups is visualized in Figure 6.



**Figure 6.** Average Direct Cost per Patient for Each Therapy Group

The lowest average direct cost was owned by the single Channa group (IDR 10,155,201), followed by the combination group (IDR 30,288,421), and the highest in the single 20% Human Albumin group (IDR

39,806,166). Interestingly, the average cost of the combination group was actually lower than that of the 20% single Human Albumin, which was due to the lower cost of surgical and nursing procedures in the combination group. This pattern confirms that in terms of procurement and service costs, snakehead fish extract-based therapy is much more economical than Human Albumin 20% [14].

The average length of stay per therapy group was also compared, as presented in Figure 7.

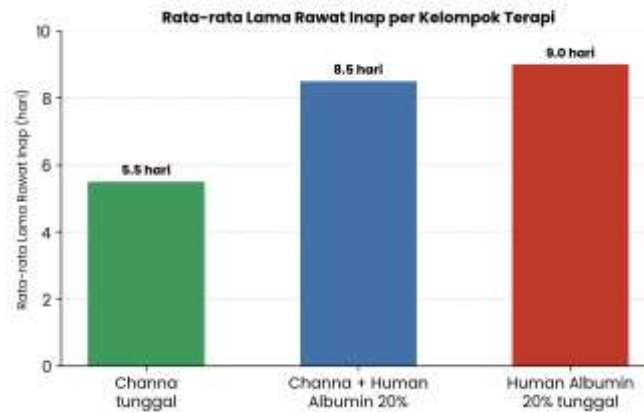


Figure 7. Average Length of Stay per Therapy Group

The mean length of hospitalization of the single Channa group was 5.5 days, a combination of 8.5 days, and the 20% Human Albumin single was 9.0 days. The combination group had a shorter average length of treatment than a single 20% Human Albumin, indicating that the administration of Channa as an adjuvant has the potential to accelerate recovery and shorten the duration of treatment, in line with the nutritional role of snakehead fish extract in accelerating tissue healing and endogenous albumin synthesis [8].

### Pharmacoeconomic Analysis (ACER and ICER)

A cost-effectiveness analysis was performed to determine the most cost-effective therapy group. Given the limited numerical value data on albumin levels in the billing file, effectiveness was measured using the length of stay as a proxy for therapy success. ACER is calculated by dividing the average direct cost by the average LOS in each group. The results of the ACER calculation are presented in Table 3.

Table 3. ACER Calculation per Therapy Group

| Therapy Group              | n  | Average Cost (IDR) | Average LOS (days) | ACER (Rp/hari) |
|----------------------------|----|--------------------|--------------------|----------------|
| Channa (single therapy)    | 2  | 10.155.201         | 5,5                | 1.846.400      |
| Human Albumin 20% + Channa | 13 | 30.288.421         | 8,5                | 3.547.293      |
| Human Albumin 20%          | 33 | 39.806.166         | 9,0                | 4.437.850      |

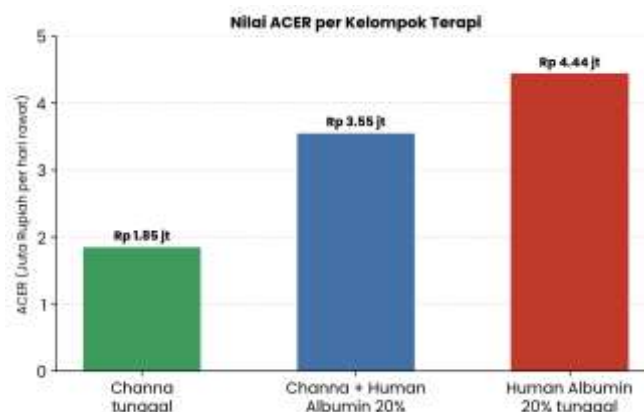


Figure 8. ACER Value per Therapy Group

Based on Table 3 and Figure 8, the lowest ACER value was for the single Channa group (IDR 1,846,400 per day of treatment), followed by the combination group (IDR 3,547,293 per day of treatment) and the highest in the single 20% Human Albumin (IDR 4,437,850 per day of treatment). This means that for every single day of hospitalization, Channa therapy costs the least amount and is the most cost-effective option based on ACER parameters. Interestingly, the combination group had a lower ACER than a single 20% Human Albumin, so the addition of Channa as an adjuvant was shown to increase the cost efficiency of therapy [15].

Furthermore, ICER was calculated to compare the difference in cost and difference in effectiveness (LOS) between the two groups in pairs. The results of the calculation are presented in Table 4.

**Table 4.** ICER Calculation Between Therapy Groups

| Group Comparison                                           | $\Delta$ Cost (IDR) | $\Delta$ LOS (days) | Interpretation          |
|------------------------------------------------------------|---------------------|---------------------|-------------------------|
| Combination (HA 20% + Channa) vs. Human Albumin 20%        | -9.517.745          | -0,5                | Combination is dominant |
| Channa (single therapy) vs. Human Albumin 20%              | -29.650.965         | -3,5                | Channa is dominant      |
| Channa (single therapy) vs. Combination (HA 20% + Channa)) | -20.133.220         | -3,0                | Channa is dominant      |

*Note:  $\Delta$  Cost and  $\Delta$  LOS both negative indicate that the first comparison group is cheaper and has a shorter duration of treatment (dominant position). Source: Data processed, 2026.*

The results of the ICER calculation showed that in the comparison of the combination group to the 20% single Human Albumin, the difference in cost was -Rp 9,517,745 and the difference in the length of treatment -0.5 days, so that combination therapy was dominant against the 20% single Human Albumin. This means that the addition of Channa as an adjuvant not only reduces costs but also provides equivalent or better clinical outcomes. Furthermore, the single Channa group is even dominant over the other two groups, which is cheaper and has a shorter duration of treatment.

Overall, both ACER and ICER parameters show a unidirectional conclusion, namely that Channa-based therapy is the most cost-effective option for the correction of hypoalbuminemia in ileus patients at the study site, either given alone in mild conditions or as an adjuvant in more severe conditions [16]. However, these findings need to be addressed with caution because the number of patients in the single Channa group is relatively very small ( $n=2$ ), and the selection of therapy in the field is strongly influenced by clinical severity. In severe hypoalbuminemia conditions that require rapid correction prior to surgical procedures, Human Albumin 20% remains an important role that cannot be completely replaced [10].

## 5. Conclusion

Based on the results of the study, the characteristics of ileus patients with hypoalbuminemia at the Imelda Pekerja Indonesia Hospital in Medan were dominated by male patients (59.2%), the infant age group of 0–1 year (44.9%), and all of them were BPJS Kesehatan participants (100%), with the most frequent comorbidities in the form of anemia and sepsis and an average length of hospitalization of 8.7 days. The total direct cost of therapy was lowest in the single Channa group (average of IDR 10,155,201/patient) and the highest in the single 20% Human Albumin (average IDR 39,806,166/patient), where Human Albumin 20% was the largest cost contributor due to its very high unit price.

Based on pharmacoeconomic analysis, the single Channa group had the lowest ACER value (Rp 1,846,400 per day of treatment), and in the ICER calculation the combination group of Human Albumin 20% + Channa

was dominant against the single Human Albumin 20% and the single Channa group was dominant against the other two groups. Thus, Channa-based therapy is the most cost-effective option for the correction of hypoalbuminemia in ileus patients at the study site, while 20% Human Albumin remains required in severe conditions that require rapid correction. Further research is recommended to use a prospective design with uniform recording of serum albumin levels, a larger and balanced sample count between groups, and the inclusion of comparative statistical tests and sensitivity analysis so that pharmacoeconomic results are stronger and generalized.

### Acknowledgments

The author would like to thank the management and staff of the Pharmaceutical Installation and Medical Records of the Imelda Pekerja Indonesia Hospital Medan for their support and access to data during the research, as well as to the Bachelor of Pharmacy Study Program, University of Imelda Medan and PT Mega Medica Pharmaceuticals (MMP) for the support provided in completing this research.

### 6. References

- [1] Purwoko, A., Setiawan, B., & Wahyuni, S. (2023). Hipoalbuminemia: Patofisiologi dan tatalaksana pada pasien rawat inap. *Jurnal Penyakit Dalam Indonesia*, 10(2), 88–97.
- [2] Witha, R., Aldi, Y., & Almahdy, A. (2024). Prevalensi dan tatalaksana hipoalbuminemia pada pasien rawat inap. *Jurnal Farmasi Klinik Indonesia*, 13(1), 25–34.
- [3] Rohmaniah, S., & Sunarno, R. (2022). Gambaran kasus gawat abdomen dan hipoalbuminemia pada pasien rawat inap rumah sakit. *Jurnal Kesehatan Masyarakat Nasional*, 12(3), 145–152.
- [4] Hasan, M., Pradana, R., & Yuliana, D. (2024). Kajian efektivitas biaya pemberian human albumin sebagai terapi tambahan. *Indonesian Journal of Clinical Pharmacy*, 13(2), 110–120.
- [5] Arisanti, P. A. M., & Noviyani, R. (2025). Tinjauan sistematis efektivitas kapsul ikan gabus (*Channa striata*) terhadap peningkatan kadar albumin pada pasien hipoalbuminemia. *Jurnal Farmasi Klinik Indonesia*, 14(1), 1–12.
- [6] Andrajati, R., Supardi, S., & Sari, I. P. (2020). *Farmakoekonomi: Konsep dan aplikasi dalam pelayanan kesehatan*. Jakarta: Penerbit Buku Kedokteran EGC.
- [7] Setiani, L. A., Hidayatullah, A., & Lestari, P. (2023). Cost-effectiveness analysis berbasis lama rawat inap pada pasien rawat inap rumah sakit. *Jurnal Farmasi Sains dan Komunitas*, 20(1), 45–55.
- [8] Isamahendra, R., Fitriansyah, A., & Andayani, T. M. (2021). Efek ekstrak ikan gabus (*Channa striata*) terhadap kadar albumin dan penyembuhan jaringan: Systematic review. *Jurnal Gizi Klinik Indonesia*, 18(2), 134–142.
- [9] Wahyuningtiyas, D., Pramesti, R., & Saputri, F. (2020). Analisis efektivitas dan biaya terapi albumin ekstrak ikan gabus murni dibandingkan human albumin 20% pada pasien hipoalbuminemia di RSUD Dr. Moewardi. *Jurnal Farmasi Indonesia*, 17(2), 90–99.
- [10] Witha, R., Aldi, Y., & Almahdy, A. (2024). Analisis efektivitas terapi human albumin pada pasien pascaoperasi dengan hipoalbuminemia. *Jurnal Farmasi Klinik Indonesia*, 13(3), 200–210.
- [11] Hayanga, A. J., Bass-Wilkins, K., & Bulkley, G. B. (2020). Current management of small bowel obstruction. *Advances in Surgery*, 54, 1–18.
- [12] Sari, D. P., Hidayat, R., & Nasution, A. (2022). Karakteristik kelainan kongenital saluran cerna pada bayi. *Jurnal Kedokteran dan Kesehatan*, 18(1), 55–64.
- [13] Hidayat, R., Ningrum, P., & Santoso, B. (2022). Hubungan anemia dan hipoalbuminemia pada pasien obstruksi saluran cerna. *Jurnal Ilmu Bedah Indonesia*, 9(2), 77–85.

- [14] Nugroho, S. A. (2016). Efektivitas ekstrak ikan gabus sebagai alternatif terapi albumin yang ekonomis. *Jurnal Farmasi Indonesia*, 8(1), 30–38.
- [15] Refasi, D., Lestari, P., & Andayani, T. M. (2018). Analisis efektivitas biaya (ACER dan ICER) terapi pada pasien rawat inap. *Jurnal Manajemen dan Pelayanan Farmasi*, 8(1), 25–34.
- [16] Heroweti, J., & Rokhmawati, D. (2023). Analisis efektivitas biaya terapi berbasis lama rawat inap pada pasien rumah sakit. *Jurnal Ilmu Farmasi dan Farmasi Klinik*, 20(2), 77–86.