

Analysis of the impact of hospitalization on fat mass index in type 2 diabetes mellitus patients at Universitas Airlangga Hospital

Firdana Aura Tyas Waradhany¹, Widati Fatmaningrum^{2,*}, Jongky Hendro Prajitno³ and Hermawan Susanto³

¹ Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

² Department of Public Health Sciences-Preventive Medicine, Universitas Airlangga, Surabaya, Indonesia.

³ Department of Internal Medicine, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

World Journal of Advanced Research and Reviews, 2025, 27(01), 1050-1055

Publication history: Received on 26 May 2025; revised on 01 July 2025; accepted on 04 July 2025

Article DOI: <https://doi.org/10.30574/wjarr.2025.27.1.2482>

Abstract

Introduction: Indonesia ranks fifth among countries or regions with the highest number of adults (20–79 years old) living with diabetes in 2021, with 19.5 million diagnosed cases and 14.3 million undiagnosed cases among the total population (IDF Diabetes Atlas 10th Edition, 2021). Malnutrition is a common problem encountered in patients with diabetes mellitus. It is frequently observed in hospitalized patients and can have serious implications for the healing process, leading to increased morbidity and mortality. Ultimately, this condition can result in prolonged hospitalization and higher healthcare costs.

Methods: This study is an observational analytic study with a longitudinal design involving hospitalized patients diagnosed with type 2 diabetes mellitus at Universitas Airlangga Hospital. Sample collection was conducted using the consecutive sampling method, yielding a total of 27 eligible participants. The study was conducted from June to July 2024. The variables analyzed in this study are fat mass as the dependent variable and hospitalization as the independent variable. Data collection involved medical records and fat mass measurements obtained through bioelectrical impedance analysis (BIA) using TANITA BC-730.

Result: The paired sample t-test results showed a significance value of >0.05 for the variable fat mass. This indicates that fat mass did not exhibit significant differences after hospitalization.

Conclusion: Fat mass in hospitalized patients with type 2 diabetes mellitus at Rumah Sakit Universitas Airlangga did not show significant differences after hospitalization.

Keywords: DMT2; Fat Mass; Hospitalization; Bioelectrical Impedance Analysis; BIA

1. Introduction

Type 2 Diabetes Mellitus (T2DM) is a complex metabolic condition that affects millions globally, with a clinical profile often characterized by chronic hyperglycemia and insulin resistance. Beyond glucose regulation, an increasingly important consideration in T2DM management is body composition, particularly fat mass. Excess adiposity, especially when centrally distributed, is well-documented as a driver of systemic inflammation, insulin resistance, and cardiovascular complications. In this context, fat mass is not merely a passive energy reserve but an active endocrine organ influencing disease outcomes. [1]

* Corresponding author: Widati Fatmaningrum

Hospitalization, a common event for individuals living with T2DM due to complications or comorbidities, introduces a unique period of physiological and behavioral change. During inpatient care, patients typically experience significant shifts in mobility, caloric intake, psychological stress, and medication regimens. These factors can directly or indirectly influence fat metabolism and body composition. While clinical management during hospitalization often prioritizes acute stabilization, the potential impact on fat mass, both gains and losses, has received limited focused attention. [2]

Emerging studies have highlighted the clinical significance of such changes. For instance, a post-hospitalization analysis by Xing and Chai (2022) demonstrated that both increases and decreases in fat mass index (FMI) were independently associated with higher mortality in T2DM patients, revealing a U-shaped risk curve. This finding suggests that rapid or unmonitored changes in body fat during stressful periods, such as hospitalization, may have lasting consequences. [19]

Moreover, fat mass distribution appears to carry functional implications. Liu et al. (2023) reported that android fat accumulation was associated with subclinical cardiac dysfunction in T2DM patients, even in the absence of diagnosed heart disease, pointing to the importance of regional adiposity assessment in hospitalized individuals (Liu et al., 2023). Similarly, evidence suggests that fat loss induced through lifestyle interventions correlates with improvements in glycemic control, yet such structured approaches are rarely implemented during hospitalization. [18]

Despite this growing body of literature, there remains a gap in our understanding of how the inpatient setting influences fat mass in T2DM patients—and more importantly, how these changes affect outcomes post-discharge. This study seeks to bridge that gap by evaluating the trajectory of fat mass during hospitalization.

2. Methods

This study employed a consecutive sampling technique, which involved enrolling patients who met the predetermined inclusion and exclusion criteria. Patients were consecutively recruited until the required sample size was achieved. This technique ensures that all eligible subjects are included without random selection, thereby allowing the study results to represent the target population more accurately.

The collected data will be processed and presented through inferential data analysis. The Shapiro-Wilk normality test will be used to determine whether the data follow a normal distribution. Variables with a normal distribution will be analyzed using the Paired Sample T-test, while variables with a non-normal distribution will be analyzed using the Wilcoxon Signed-Rank test. The interpretation of the analysis results will be based on the acceptance or rejection of the hypothesis, determined by the p-value. A p-value of <0.05 will be considered statistically significant. This study was approved by the ethics committee of Universitas Airlangga Hospital with ethical clearance certificate number an 088/KEP/2024

3. Results

Universitas Airlangga Hospital is a type B teaching hospital under Universitas Airlangga, established to strengthen healthcare development in Indonesia. The hospital is located at Universitas Airlangga Campus C, Jl. Dharmahasada Permai, Mulyorejo District, Surabaya. inaugurated on June 14, 2014, Universitas Airlangga Hospital currently provides various healthcare services, including installations, emergency, inpatient, and outpatient care, clinical nutrition, laboratory services, pharmacy, physical medicine and rehabilitation, medical check-ups, radiology, and research laboratories. The subjects were divided into two age groups: the adult group, which included 20 subjects under the age of 60 years with a mean age of 49.25 ± 5.92 years (minimum age 40, maximum age 57), and the elderly group, which consisted of 7 subjects over the age of 60 years with a mean age of 67.85 ± 6.74 years (minimum age 60, maximum age 78). In terms of gender, 10 subjects (37.03%) were male, while 17 subjects (62.96%) were female. The average length of hospitalization was 2.81 ± 1.11 days. Based on the duration of hospitalization, 2 subjects (7.4%) were categorized in the daily group (<24 hours), 19 subjects (70.37%) in the short-term group (24–72 hours), and 6 subjects (22.22%) in the conventional group (72 hours to 14 days). The characteristics of the research subjects, including age, gender, length of hospitalization, and body composition, are presented in Table 1.

Table 1 Characteristics of Research Subjects

No	Characteristic	Category	f	%
1.	Age	Adult (<60 tahun)	20	74.07%
		Elderly (>60 tahun)	7	25.92%
2.	Gender	Male	10	37.03%
		Female	17	62.96%
		Daily (< 24 hours)	2	7.4%
3.	Length of Stay	Short (24-72 hours)	19	70.37%
		Conventional (72 hours -14 days)	6	22.22%

This study involved 27 subjects, with a comparison of body composition variables at hospital admission (HA) and hospital discharge (HD). Fat mass showed a slight decrease from $33.14 \pm 9.07\%$ at HA to $33.06 \pm 9.48\%$ at HD as presented in Table 2.

Table 2 Average Body Composition Assessment in Subjects

Variabel		f	Minimum	Maximum	Mean \pm SD	Normal Range
Fat Mass	HA	27	16.50	48.00	33.14 ± 9.07	Female: 21-29%
	HD	27	15.40	48.80	33.06 ± 9.48	Male: 9-19%

This study involved 27 subjects, with a comparison of body composition variables at hospital admission (HA) and hospital discharge (HD) The fat mass showed a slight decrease from $33.14 \pm 9.07\%$ at HA to $33.06 \pm 9.48\%$ at HD as presented in Table 3.

Table 3 Cross-Tabulation of Length of Hospitalization with Fat Mass

Variable	Hospital Admission (HA)				Hospital Discharge (HO)			
	Normal		Not Normal		Normal		Not Normal	
	f	%	f	%	f	%	f	%
Fat Mass								
Female	0	0	17	62.96	0	0	17	62.96
Male	2	7.4	8	29.62	2	7.4	8	29.62

The results of statistical testing show that the significance values for the four variables analyzed under two conditions, namely hospital admission (HA) and hospital discharge (HD), with each condition involving 27 subjects, were all greater than 0.05 for each variable. It can be concluded that there is no significant difference between body fat mass at the time of hospital discharge (HD) and hospital admission (HA). With a significance value of 0,658 for the "Body Fat Mass" variable, hospitalization does not have a significant effect on the subjects' weight. The data is presented on Table 4.

Table 4 Difference in Body Fat Mass at Hospital Admission (HA) and Hospital Discharge (HD) Based on Paired Sample T-test

Variable	HA	HD	<i>p-value</i>	Interpretation
Body Fat Mass (%)	33.14	33.06	0.658	Hospitalization does not affect Body Fat Mass

4. Discussion

20 respondents (74.07%) were adults, aged under 60 years. The increasing incidence of type 2 diabetes mellitus among the elderly is driven by degenerative factors that impair the body's ability to metabolize glucose (Rohmatulloh, et al., 2024). This finding is supported by Susanti's study, which observed a rise in type 2 diabetes mellitus cases among individuals under 40 years of age due to unhealthy lifestyles and the consumption of high-calorie foods. [6]

Of the participants, 17 (62.96%) were female and 10 (37.03%) were male. This study showed a higher prevalence of type 2 diabetes mellitus in females compared to males. This is supported by Rohmatulloh's research (2024), which suggests that women have a higher risk of diabetes due to biological and hormonal factors. Estrogen and progesterone can enhance the body's response to insulin. During menopause, the reduction of estrogen and progesterone levels decreases the body's ability to respond to insulin. [7]

Most of the respondents were hospitalized for a short period (24-72 hours), with 19 respondents (97.37%) admitted for a short stay. A total of 6 respondents (22.22%) underwent conventional Hospitalized care (72 hours to 14 days), and 2 respondents (7.4%) were admitted for less than 24 hours. The length of hospitalization can be influenced by malnutrition status. Patients with malnutrition tend to have longer hospital stays compared to those without malnutrition. In this study, 15 respondents (66.66%) had an abnormal Body Mass Index (BMI) upon hospital admission. The presence of complications can also affect the duration of hospitalization, with patients who have more complications requiring a longer hospital stay. [8]

The average body fat mass in this study was 33%, which exceeds the normal fat mass range. The normal body fat for women is 21-29%, and for men, it is 19-29%. In this study, 17 female respondents had a higher than-normal body fat percentage (>28%) both at the time of hospital admission (HA) and discharge (HD). Among the 10 male respondents, 8 had excess body fat, while 2 had normal fat mass both during admission (HA) and discharge (HD). Excess body fat is linked to blood sugar levels because excessive fat can cause insulin resistance, increasing the risk of diabetes (Lisnawati, et al., 2023). This aligns with a study conducted in China, which found that higher body fat mass was more strongly associated with diabetes incidence compared to BMI (Zhao, et al., 2017). The study also found that women tend to have higher body fat mass than men, even with the same BMI. Women's body fat is generally higher due to hormonal factors, with estrogen influencing fat mass storage and distribution. [9]

Based on the results of the Paired Sample T-Test, it was found that hospitalization had no significant relationship with fat mass in patients with type 2 diabetes mellitus, with a p-value > 0.05. In this study, most patients were hospitalized acutely for a short duration. Alley, in his research, stated that there are significant changes in body composition, such as fat mass in hospitalized patients, especially over a period of 8 days or more within a year. [13]

The lack of significant changes in fat mass in this study may be influenced by the relatively short hospitalization duration, some studies question the extent to which short-term hospitalization truly affects fat mass in a clinically meaningful way. For instance, Magalhães et al. (2021) noted high interindividual variability in fat mass response to physical interventions in T2DM patients. Even when undergoing the same training protocols, some individuals ("non-responders") showed minimal changes in body composition. If such variability exists in outpatient settings, it may be even more pronounced during brief hospitalizations, where patients are often sedentary and acutely ill. [17]

5. Conclusion

Hospitalization for patients with type 2 diabetes mellitus at the Universitas Airlangga Hospital does not affect body fat mass no significant difference between admission (HA) and discharge (HD).

Compliance with ethical standards

Acknowledgments

The authors would like to express their gratitude to the staff of the Department of Internal Medicine, Universitas Airlangga Hospital, Surabaya, for their invaluable support and cooperation. Special appreciation is also extended to the patient who has agreed to become the subject of this research also directed to Internal Medicine Residency Program Universitas Airlangga assists in sorting and selecting patients whose data will be collected for research purposes.

Disclosure of conflict of interest

The authors declared there is no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants in the study.

Funding

This study does not receive any funding.

Authors' Contributions

Firdana Aura Tyas Waradhany, Widati Fatmaningrum, Jongky Hendro Prajitno, and Hermawan Susanto participated in research design formulation, collecting and analysing data, and paper writing.

References

- [1] Prasetyo, W.H., Pramantara, I.D.P. and Budiningsari, R.D. (2016) 'Hasil skrining berdasarkan metode MNA (mini nutritional assestment) tidak berhubungan terhadap lama rawat inap dan status pulang pasien lanjut usia di RSUP Dr. Sardjito Yogyakarta' [Screening results based on the MNA (mini nutritional assessment) method are not related to length of stay and discharge status of elderly patients at RSUP Dr. Sardjito Yogyakarta], *Jurnal Gizi dan Dietetik Indonesia (Indonesian Journal of Nutrition and Dietetics)*, 2(2). Available at: [https://doi.org/10.21927/ijnd.2014.2\(2\).75-84](https://doi.org/10.21927/ijnd.2014.2(2).75-84).
- [2] Nurparida, I.S., Marhaeni, D. and Arisanti, N. (2017) Peran Tim Terapi Gizi (TTG) dalam mengatasi Malnutrisi Pasien Selama Dirawat di Rumah Sakit The role of the Nutrition Therapy Team (TTG) in addressing malnutrition in patients during hospitalization: A literature review.
- [3] Diabetes Atlas 10th edition.
- [4] KEPUTUSAN KEMENTERI KESEHATAN REPUBLIK INDONESIA (2019)
- [5] Pedomann Pengelolaan dan Pencegahan Diabetes melitus tipe 2 [Decision of the Minister of Health of the Republic of Indonesia (2019)]. PERKENI July 2021 edition.
- [6] Susanti, N., Syahpira, D. D., Aulia, S. T., and Syahmala, A.R. (2024). HUBUNGAN USIA PADA KEJADIAN DIABETES MELITUS TIPE-2 DENGAN PENDEKATAN STEPWISE [The relationship of age to the incidence of type-2 diabetes mellitus with a stepwise approach]. *Jurnal Kesehatan Tambusai*, 5(2), 4283-4288. <https://doi.org/10.31004/jkt.v5i2.28312>.
- [7] Lestari, Zulkarnain., dan Sijid S.T.A. (2021) Diabetes Melitus: Review Etiologi, Patofisiologi, gejala, Penyebab, Cara Pemeriksaan, Cara Pengobatan, dan Cara Pencegahan [Diabetes Mellitus: A review of etiology, pathophysiology, symptoms, causes, examination methods, treatment methods, and prevention methods]. *Journal UIN Alauddin*.
- [8] Santoso, S. P., Desiana, N. R., Kusumastuty, I. and Restyani, I. (2021) HUBUNGAN ANTARA STATUS GIZI DENGAN LAMA RAWAT INAP PADA PASIEN DIABETES MELITUS TIPE 2 DI INSTALASI RAWAT INAP I ILMU PENYAKIT DALAM RSUD Dr. SAIFUL ANWAR MALANG [The relationship between nutritional status and length of stay in type 2 diabetes mellitus patients in inpatient unit I of internal medicine at RSUD Dr. Saiful Anwar Malang]. *Majalah Kesehatan* 8(1).
- [9] Haryadi, S. W., Nugraha, S., dan Kawuryan, D.L. (2023) Hubungan antara Konsumsi Makanan Cepat Saji, Jenis Kelamin, dan Aktivitas Fisik dengan Persentase Lemak Tubuh pada Siswa SMP di Surakarta [The relationship between fast food consumption, gender, and physical activity with body fat percentage in junior high school students in Surakarta]. *GHIDZA: Jurnal Gizi dan Kesehatan*, 7(1). <https://doi.org/10.22487/ghidza.v7i1.613>.
- [10] Hayati, F., Hariyanto, T. and Vita, M. (2016) 'Hubungan Lama Rawat Inap Dengan Status Nutrisi Pada Pasien Yang Dirawat Di Ruang ICU RS Panti Waluya Malang' [Relationship between length of stay and nutritional status in patients treated in the ICU room of Panti Waluya Hospital Malang], *Nursing News*, 1(1).
- [11] Van Ancum, J.M., Scheerman, K., Jonkman, N.H., Smeenk H.E., Kruizinga, R.C., Meskers, C.G.M. and Maier, A.B. (2017). Change in muscle strength and muscle mass in older hospitalized patients: A systematic review and meta-analysis. *Experimental Gerontology*, 92, pp.34-41. doi: <https://doi.org/10.1016/j.exger.2017.03.006>.

- [12] Van Ancum, J.M., Scheerman, K., Pierik, V.D., Numans, S.T., Verlaan, S., Smeenk, H.E., Slee- Valentijn, M., Kruizinga, R.C., Meskers, C.G.M. and Maier, A.B. (2017). Muscle Strength and Muscle Mass in Older Patients during Hospitalization: The EMPOWER Study. *Gerontology*, 63(6), pp.507–514. Doi <https://doi.org/10.1159/000478777>.
- [13] Alley, D.E., Koster, A., Mackey, D., Cawthon, P., Ferrucci, L., Simonsick, E.M., Yu, B., Hardy, S., Goodpaster, B., Sarkisian, C., Houston, D.K., Kritchevsky, S.B., Cummings, S., Lee, J.-S., Tylavsky, F.A., Newman, A. and Harris, T. (2010). Hospitalization and Change in Body Composition and Strength in a Population-Based Cohort of Older Persons. *Journal of the American Geriatrics Society*, 58(11), pp.2085–2091. doi:<https://doi.org/10.1111/j.1532-5415.2010.03144.x>
- [14] Lipoeto, N. I., Megasari, N., dan Putra, A. E. (2014). Malnutrisi dan Asupan Kalori pada PAsien Rawat Inap di Rumah Sakit. *Majalah Kedokteran Indonesia [Malnutrition and Calorie Intake in Hospitalized Patients]*, 56(11).
- [15] Meilyana, F., Djais, J., dan Garna, H. (2010). Status Gizi Berdasarkan Subjective Global Assessment sebagai Faktor yang Memengaruhi Lama Perawatan Pasien Rawat Inap Anak, Sari Pediatri [Nutritional Status Based on Subjective Global Assessment as a Factor Influencing Length of Stay in Hospitalized Pediatric Patients], 12(3).
- [16] Magalhães, J., Hetherington-Rauth, M., Júdice, P., Correia, I., Rosa, G., Henriques-Neto, D., Melo, X., Silva, A., and Sardinha, L., 2021. Interindividual Variability in Fat Mass Response to a 1-Year Randomized Controlled Trial With Different Exercise Intensities in Type 2 Diabetes: Implications on Glycemic Control and Vascular Function. *Frontiers in Physiology*, 12. <https://doi.org/10.3389/fphys.2021.698971>.
- [17] Igarashi, Y., Akazawa, N., and Maeda, S., 2023. Effects of Changes in Body Fat Mass as a Result of Regular Exercise on Hemoglobin A1c in Patients with Type 2 Diabetes Mellitus: A Meta-Analysis. *International journal of sport nutrition and exercise metabolism*, pp. 1-13. <https://doi.org/10.1123/ijsnem.2022-0217>.
- [18] Xing, Z., and Chai, X., 2022. Changes in fat mass and lean body mass and outcomes in type 2 diabetes mellitus. *Internal and Emergency Medicine*, 17, pp. 1073 - 1080. <https://doi.org/10.1007/s11739-021-02916-4>.