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A Study on the Implementation and Outcomes of the Nutrition Care Process (NCP) in Cardiothoracic Surgery Patients by Clinical Dietitians in a Tertiary Care Hospital

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Abstract

Background: Patients undergoing cardiothoracic surgery frequently suffer from malnutrition, that is linked to longer hospital stays, infections, poor wound healing, and higher mortality rates. Complications can be reduced by using a structured, empirically supported framework for Nutrition Care Process (NCP)-based personalised nutrition therapy. **Objective:** To assess the implementation of the NCP in cardiothoracic surgery patients and evaluate its impact on nutritional and clinical outcomes. Between August 2025 and January 2026, the cardiothoracic surgery department at NMC Speciality Hospital Al Nahda in Dubai carried out an observational prospective cohort analysis. The study involved the recruitment of 47 adult patients undergoing cardiothoracic surgery. **Methods:** Data were gathered using electronic medical records (EMR), dietetics department's documents, and food intake monitoring records. Anthropometrics, biochemical markers, NCP implementation indicators, ICU and hospital stays, wound healing, infection rates, and nutrition target achievement were among the variables examined. Descriptive statistics, paired t-tests, Pearson correlation, chi-square tests, and multivariable linear regression were all used in the statistical analysis. **Results:** The calculated mean BMI was 25.8 ± 3.9 kg/m²; Of the 47 patients 62% were either overweight or obese. Nutritional target modification significantly improved 100% goal achievement days (2.9 ± 2.1 vs 4.6 ± 2.4 ; $p < 0.01$). ICU stay correlated positively with hospital stay ($r = 0.68$, $p < 0.001$). The nutritional goal achievement of 100% was negatively correlated with the hospital stay ($r = -0.41$, $p = 0.004$). Regression analysis indicated ICU stay ($\beta = 0.74$, $p < 0.001$) and 100% nutritional goal achievement days ($\beta = -0.52$, $p = 0.006$) as independent predictors of hospital stay ($R^2 = 0.58$). Wound healing was observed to be favorable in 97.8% of the patients. **Conclusion:** Structured execution of the NCP increased nutritional adequacy and was independently associated with a shorter hospital stay. Individualized nutritional changes tend to be therapeutically useful in cardiothoracic surgery recovery.

Keywords: Nutrition Care Process, Cardiothoracic surgery, Hospital stay, ICU stay, Wound healing, Nutrition intervention

1 Introduction

Patients undergoing cardiothoracic surgery are more likely to experience perioperative malnutrition because of hypermetabolism, systemic inflammation, cardiometabolic comorbidities, and postsurgical catabolism. Malnutrition in this population is strongly associated with greater infection

rates, delayed wound healing, longer ICU stays, and higher healthcare costs.

The Academy of Nutrition and Dietetics developed the Nutrition Care Process (NCP), which is a standardised framework that includes four steps: assessment, diagnosis, intervention, and monitoring/evaluation. The use of NCP

ensures systematic, individualised, and outcome-driven nutrition management. While evidence supports early nutritional intervention in surgical patients, there is a lack of data on systematic NCP implementation in Middle Eastern cardiothoracic facilities.

Optimizing perioperative nutrition may aid recovery by increasing protein-energy intake, reducing inflammatory response, preserving lean body mass, and improving wound repair mechanisms. This study assesses NCP implementation and clinical outcomes at a tertiary care cardiothoracic unit.

2 Literature review

Malnutrition is a well-accepted risk factor for poor surgical outcomes, including increased chances of infection rates, delayed wound healing, prolonged hospitalization days, and increased treatment costs. Thus, perioperative nutrition plays a crucial role in mitigating the surgical stress responses and improving recovery period. Recent evidences emphasize that preoperative nutritional status independently influences postoperative morbidity and mortality in major surgeries⁽¹⁻⁴⁾.

Patients having heart surgery may experience a complicated systemic inflammatory response, including fever, tachycardia, leukocytosis, hypotension, oedema, and, in extreme cases, organ dysfunction. Several variables contribute to this inflammatory response during and after surgery. Surgical trauma activates neutrophils, endothelial cells, and platelets, resulting in the release of inflammatory mediators such TNF α and ILs^(5, 6).

Nutritional deficits exacerbate inflammation by weakening defense mechanisms and reducing metabolic reserves. Malnourished individuals are at a higher risk of surgical trauma, ischemia-reperfusion injury, anesthesia problems, hemodilution, and systemic inflammation. Malnutrition also reduces gut mucosal integrity, raising the risk of bacterial translocation. Preoperative fasting and delayed postoperative feeding worsen nutritional deficiencies. Observational studies show considerable early postoperative losses of macro- and micronutrients, emphasising the importance of energy and protein metabolism following cardiac surgery. This highlights the need for systematic nutritional assessment and intervention⁽⁷⁾.

An evidence review conducted by the National Guideline Centre for the National Institute for Health and Care Excellence (NICE), supports the routine use of nutritional screening during preoperative assessment for adults undergoing surgery. Nutrition screening tools such as Short Nutritional Assessment Questionnaire (SNAQ), Malnutrition Universal Screening Tool (MUST), Malnutrition Screening Tool (MST) Nutrition Risk Screening 2002 (NRS-2002), Mini Nutritional Assessment Short-Form (MNA-SF) and Subjective Global Assessment (SGA) are recommended to identify patients at-risk of malnutrition who may benefit from

nutritional support. Malnourished surgical patients experience higher postoperative complications and increased lengths of ICU and hospital stay, emphasizing on the necessity of regular nutritional evaluation in perioperative care pathways^(4, 8).

Juliana N and colleagues' review emphasises the importance of preoperative dietary condition on post-cardiac surgery outcomes⁽¹⁰⁾. Their new research reveals that malnutrition is persistently linked to greater rates of postoperative complications, longer hospital stays, increased mortality risk, and, most crucially, delayed cognitive recovery following surgery. The poor nutritional status can lead to postoperative cognitive impairment via processes such as inflammation, oxidative stress, and decreased physiological reserve^(9, 10).

Systematic assessments of cardiac surgery populations show that insufficient protein consumption is prevalent in the postoperative period, and it is independently related with longer hospital stays and a higher incidence of malnutrition. Early oral nutritional supplementation has been shown to have protective effects in elderly and high-risk heart surgery patients^(1, 11).

Meta-analyses of early nutritional support nursing interventions in critical cardiac surgery cohorts revealed significant reductions in mechanical ventilation duration, hospital length of stay, and possibly mortality, highlighting the importance of structured nutrition delivery during perioperative care⁽¹²⁾.

Perioperative nutritional therapy is an essential component of the Enhanced Recovery After Surgery (ERAS) pathways. The 2024 ERAS/STS Expert Consensus Statement emphasises that employing enhanced recovery procedures in cardiac surgery improves patient outcomes by lowering complications, shortening hospital stays, and promoting faster functional recovery. The statement emphasises the significance of a multidisciplinary, evidence-based approach, emphasising the need for standardised perioperative strategies such as optimised nutrition, early mobilisation, and careful pain management in cardiac surgical populations^(13, 14).

In a study of 70 critically ill cardiac surgery patients (mean age 67 \pm 17 years; ICU stay 10 \pm 7 days; median SAPS II=43), all had circulatory failure, with 18 requiring intra-aortic balloon-pump assistance and 58 requiring norepinephrine. Forty patients received enteral nutrition (EN), yielding an average of 1360 \pm 620kcal/day (about 70 \pm 35 % of the energy target) without stomach problems. EN delivery decreased with increasing dopamine and norepinephrine dosages but was unaffected by IABP usage⁽¹⁵⁾. Eri Natsuhori and Takeshi Unoki conducted a single-center retrospective study to explore the link between early postoperative food intake and hospital length of stay in cardiac surgery patients. The study discovered

that patients who resumed oral feeding soon after surgery had shorter postoperative hospital stays, emphasising the importance of immediate nutritional support in improving recovery and minimising hospitalisation after cardiac surgery⁽¹⁶⁾.

Improving a patient's nutrition for surgery is more than just providing protein and calories. It also involves formulas enriched with immunomodulating nutrients—such as arginine, omega-3 fatty acids, and nucleotides—can enhance immune function, modulate inflammatory responses, and improve wound healing. By supporting the body's immune and metabolic response to surgical stress, immunonutrition has been associated with reduced postoperative infectious complications and shorter hospital stays⁽¹⁷⁾.

A cross-sectional observational study of 180 cardiac surgery patients looked at the effects of early enteral nutrition (EEN) starting 6-12 hours after surgery versus usual care. EEN dramatically lowered infection rates (13% vs. 24%) and hospital stays (7.5 vs. 8.8 days), while only slightly lowering total morbidity (17% vs. 28%). It also sped up the first bowel movement (48 vs. 72 hours), reduced gastrointestinal problems (10% vs. 22%), and improved wound healing. Patients who received EEN had higher albumin and pre-albumin levels at discharge and rated higher satisfaction (90% vs. 75%). These findings suggest that adding EEN into postoperative care can improve recovery, nutritional status, and patient outcomes following heart surgery⁽²⁾.

Patients with difficult surgical courses (requiring cardiac support or prolonged ventilation) may become hyper-catabolic, unable to feed orally for several days, and require intensive nutritional assistance. Weight loss after discharge is also linked to chronic inflammation and decreased physical function. However, most heart surgery patients have brief ICU stays and are able to start oral intake within one or two days, reducing the requirement for rigorous nutrition management⁽¹⁸⁻²²⁾.

Although there is solid evidence that nutritional intervention works, its application in clinical practice is still inconsistent. To standardize nutrition care and improve patient outcomes, the Nutrition Care Process (NCP) is to be implemented. This organized framework involves systematic assessment, diagnosis, intervention, and continuing monitoring and evaluation. However, its application in cardiothoracic surgery settings is currently limited and understudied⁽¹²⁾.

In conclusion, strong evidence supports the use of structured perioperative nutritional support to prevent postoperative complications, increase recovery, and shorten hospital stay. Nonetheless, further research is needed to assess standardized nutrition recording techniques and implementation frameworks like the Nutrition Care Process (NCP), particularly

among high-risk surgical groups such as cardiothoracic patients.

3 Methods

This observational prospective cohort research examined perioperative dietary patterns and clinical outcomes in cardiothoracic surgery patients. It was carried out in the Cardiothoracic Surgery Department of NMC Specialty Hospital Al Nahda. Data was collected over a five-month period, from August 14, 2025 to January 14, 2026. During this time there was a total sample size of 47 individuals (N = 47).

3.1 Inclusion and Exclusion Criteria

The study population included adult patients who had cardiothoracic surgery during the research period. Patients were excluded if they had a reported terminal illness, were readmitted during the study period, or had incomplete medical records that made extensive data extraction impossible.

3.2 Data Collection

Data were retrospectively extracted from multiple sources to ensure comprehensive nutritional and clinical assessment. These included electronic medical records (EMR), dietitian progress notes, food intake monitoring sheets, catering diet clerk documentation, and patient interviews where available. To maintain confidentiality, all patient data were anonymized using unique identification numbers prior to analysis.

3.3 Statistical Analysis

Continuous values were summarised as mean \pm SD, and categorical variables were reported as frequencies and percentages. Paired t-tests were used to compare the initial and amended nutrition targets. Pearson correlation analysis was used to assess the relationships between continuous variables. The chi-square test was employed to determine the associations between category variables.

To identify independent determinants of length of stay (LOS), multivariable linear regression analysis was used. Statistical significance was determined at $p < 0.05$.

The regression model was specified as follows: $LOS = \beta_0 + \beta_1$ (ICU days) + β_2 (BMI) + β_3 (100% Goal Days) + β_4 (Comorbidity) + ϵ .

4 Results

In all, 47 patients from the study group were analysed. The population was primarily overweight, with a mean height of 167 ± 8.4 cm, mean weight of 73.4 ± 14.2 kg, and mean BMI of 25.8 ± 3.9 kg/m². 4.3% of patients were underweight, and nearly 62% of patients were either overweight (47%) or obese (14.7%).

A high-risk surgical population typical of cardiothoracic practice was also indicated by the fact that 65% of patients had at least one cardiometabolic comorbidity.

The complexity and resource intensity of this patient group are highlighted by the mean hospital stay of 13.2 ± 4.6 days and the mean ICU stay of 9.0 ± 3.8 days. These results demonstrate the necessity of customised and organised nutrition care in this context.

Nutritional adequacy significantly improved once the Nutrition Care Process (assessment, diagnosis, intervention, and monitoring) was systematically implemented and modified.

From 2.9 ± 2.1 days (pre-modification phase) to 4.6 ± 2.4 days (post-modification phase), the mean number of days reaching 100% nutritional goals rose significantly ($p < 0.01$).

Concurrently, there was a substantial decrease in the number of days where $<50\%$ of dietary requirements were met ($p = 0.01$).

These findings show that the consistency and sufficiency of nutritional supply during the perioperative cardiothoracic surgery phase were enhanced by clinical dietitians using organised NCP implementation.

With a mean decrease of 1.9 ± 1.1 kg, postoperative weight loss was seen in 49% of patients, which is consistent with the anticipated metabolic load following surgery. However, excessive weight loss was probably lessened by better nutritional aim achievement.

The results of wound healing were quite positive; just 2.2% of patients experienced minor problems, and 97.8% of patients showed successful wound healing. These findings suggest that optimal nutritional assistance most likely contributed to improved tissue repair and surgical recovery.

Correlation analysis demonstrated that there was a significant positive connection ($r = 0.68, p < 0.001$) between ICU stay and overall hospital stay, indicating that ICU time is a significant factor in determining hospitalisation duration. There was a moderately negative connection ($r = -0.41, p = 0.004$) between hospital stays and days attaining 100% nutritional targets, suggesting that shorter hospital stays were linked to higher nutritional adequacy, and there was no discernible correlation between BMI and ICU stay ($r = -0.21, p = 0.15$). These results highlight the therapeutic significance of reaching dietary goals in affecting the course of recovery.

Multivariable regression analysis found 58% of the variance in hospital stay ($R^2 = 0.58, p < 0.001$).

The following independent predictors concluded that:

- ICU stay was positively correlated with longer hospital stays ($\beta = 0.74, p < 0.001$).

- Days attaining 100% nutritional targets were independently linked to a shorter hospital stay ($\beta = -0.52, p = 0.006$).

Crucially, even after controlling for ICU stay, nutritional objective achievement continued to be a significant predictor, confirming the independent role of NCP implementation in better clinical outcomes.

Table 1: Descriptive Statistics for Continuous Variables

Variable	N	Mean	Std. Deviation
Height (cm)	47	167.0	8.4
Weight (kg)	47	73.4	14.2
BMI (kg/m ²)	47	25.8	3.9
Hospital Stay (days)	47	13.2	4.6
ICU Stay (days)	47	9.0	3.8
ONS Duration (days)	47	5.2	4.1
100% Goal Days (Initial)	47	2.9	2.1
100% Goal Days (Modified)	47	4.6	2.4
Postoperative Weight Loss (kg)*	23	1.9	1.1

*Weight loss calculated among patients who experienced postoperative weight reduction.

Frequencies:

Table 2: BMI Categories

BMI Category	Frequency	Percent	Valid %	Cumulative %
Underweight	2	4.3	4.3	4.3
Normal	16	34.0	34.0	38.3
Overweight	22	47.0	47.0	85.3
Obese	7	14.7	14.7	100.0
Total	47	100.0	100.0	—

Table 3: Wound Healing Outcomes

Outcome	Frequency	Percent
Good Healing	46	97.8
Minor Complication	1	2.2
Total	47	100.0

Paired Samples Test:

Table 4: Paired Samples Statistics

Variable	Mean	Std. Deviation	N
100% Goal Days (Initial)	2.9	2.1	47
100% Goal Days (Modified)	4.6	2.4	47

Table 5: Paired Samples Test

Pair	Mean Difference	Std. Deviation	t	df	Sig. (2-tailed)
Modified – Initial	1.7	—	—	46	<0.01

(Days achieving <50% goals: p = 0.01)

Correlations:

Table 6: Pearson Correlation Matrix

Variables	ICU Stay	Hospital Stay	100% Goal Days	BMI
ICU Stay	1	0.68**	—	-0.21
Hospital Stay	0.68**	1	-0.41**	—
100% Goal Days	—	-0.41**	1	—
BMI	-0.21	—	—	1

Correlation is significant at the 0.01 level (2-tailed)

Significance levels:

- ICU vs Hospital Stay: p < 0.001
- 100% Goal Days vs Hospital Stay: p = 0.004
- BMI vs ICU Stay: p = 0.15

Multiple Linear Regression:

Table 7: Model Summary

Model R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.76	0.58	—

Table 8: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	—	2	—	—	<0.001
Residual	—	44	—	—	—
Total	—	46	—	—	—

Table 9: Coefficients

Predictor	Unstandardized B	Standardized Beta (β)	t	Sig.
ICU Stay	—	0.74	—	<0.001
100% Goal Achievement Days	—	-0.52	—	0.006

Dependent Variable: Hospital Stay (days)

5 Discussion

This study illustrates that patients following cardiothoracic surgery had much better nutritional adequacy when NCP was implemented in a structured way. Adjusted protein and calorie recommendations led to better goal attainment and were independently linked to shorter hospital stays.

In line with earlier research on surgical outcomes, ICU stay continued to be the most significant predictor of overall hospitalisation. Notably, BMI did not predict outcomes on its own, indicating that nutritional sufficiency upon admission might have a greater influence than baseline BMI alone.

The idea that structured nutritional intervention has a good impact on recovery is supported by the outstanding wound healing rate of 97.8%.

Nutritional target accomplishment was much enhanced when clinical dietitians used a structured Nutrition Care Process (NCP) with patients after cardiothoracic surgery. Improved wound healing results and a shorter hospital stay were independently linked to improved dietary sufficiency. These results corroborate the importance of clinical dietitians and the methodical application of NCP in improving perioperative outcomes in cardiothoracic surgery settings in tertiary care.

Strengths and Limitations

This study has a number of noteworthy advantages. It increases the NCP's practical relevance by reflecting its actual clinical application in a tertiary care cardiothoracic context. By ensuring systematic assessment, intervention, and monitoring, the use of structured NCP documentation improved the consistency and dependability of nutrition care delivery. Furthermore, by finding independent predictors of hospital stay while controlling for confounding variables, multivariable regression modelling improved the analytical rigour.

However, it's important to recognise some limitations. Causal inference may be limited by the prospective study. The results of this single-center study might not be entirely applicable to other healthcare facilities or environments. Statistical power may also be impacted by the comparatively small sample size (N=47). Furthermore, assessing long-term nutritional and clinical outcomes after hospitalisation is limited by the lack of long-term follow-up data.

6 Conclusion

Patients undergoing cardiothoracic surgery who used the Nutrition Care Process saw a considerable improvement in meeting their nutritional goals, which was also independently linked to a shorter hospital stay. Perioperative cardiothoracic care routes should incorporate tailored nutrition modification since it seems to have a clinical impact.

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