

Effect of Preoperative Energy Drink on Intraoperative Body Temperature

A Prospective, Open-Label, Non-Inferiority RCT in Elective Cesarean Delivery

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Rising Cesarean Delivery Rates

28.5%

Projected global rate by 2030, of which 88.2% in Low and Middle-Income Countries

Intraoperative Hypothermia Risk

↑ Morbidity

Increases risk of SSI, PPH, and bleeding complications

Active Warming Devices

Expensive & Scarce

High cost; unavailable in resource-limited settings globally

Research Gap

No RCT Evidence

Thermoprotective efficacy of energy drinks in obstetric anesthesia was untested

Hypothesis

Energy drink is NOT clinically inferior to warming mattress

Preoperative Drink Comparison

Feature	Nutricia preOp®	ClearFast®	Ensure Pre-Surg®	Gatorade®	Red Bull® (study)
ERAS endorsed	✓ Gold	✓ Yes	✓ Yes	⚠ Off-label	✗ No
Volume	400 mL	355 mL	296 mL	591 mL	250 mL
Carbohydrates	50 g	50 g	26 g	35 g	27 g
Carb type	Maltodextrin (complex)	Maltodextrin (complex)	Simple + Maltodextrin	Simple sugars	Sucrose + glucose
Carb conc.	12.5%	14%	~9%	~6%	~11%
Calories	200 kcal	200 kcal	100 kcal	140 kcal	110-130 kcal
Caffeine	✗ None	✗ None	✗ None	✗ None	✓ 50 mg
Taurine	✗ None	✗ None	✗ None	✗ None	✓ 125 mg
Osmolality	240 mOsm/L	270 mOsm/L	550 mOsm/L	280 mOsm/L	330 mOsm/L
Gastric empty	Fast	Fast	Moderate	Fast	Moderate
Carbonated	✗ No	✗ No	✗ No	✗ No	✓ Yes
B-vitamins	✗ No	✗ No	✓ Yes	✗ No	✓ B3,B5, B6,B12
Cost	High \$5–10	High \$5–8	Mod \$3–5	Low \$1–2	Very Low < \$1
LMIC access	✗ Limited	✗ Limited	⚠ Variable	✓ Wide	✓ Wide
Evidence	✓ Extensive	✓ Good	✓ Moderate	⚠ Limited	✓ This RCT

✓ Favorable ⚠ Partial / Off-label ✗ Absent

Study Design & Methods

TRIAL TYPE

Open-Label, Non-Inferiority RCT

Suqian Maternity & Child Hospital
Jan 2023–Dec 2025

PARTICIPANTS

Inclusion Criteria

- Healthy women >18 y
- singleton pregnancy
- 38–40 wks gestation · ASA II
- BMI <35 kg/m²
- Elective Cesarean with CSEA

Exclusion Criteria

- CSEA contraindications
- Diabetes
- Hypertension
- Preoperative body temperature exceeding 38 °C or below 36 °C

INTERVENTION ARMS

Energy Drink Group (n = 149)

Intervention:

Red Bull® 250 mL · 2 h before surgery

VS

Warming Mattress Group (n = 147)

Intervention: Active warming mattress at 40°C

Applied post-anesthesia induction, maintained intraoperatively

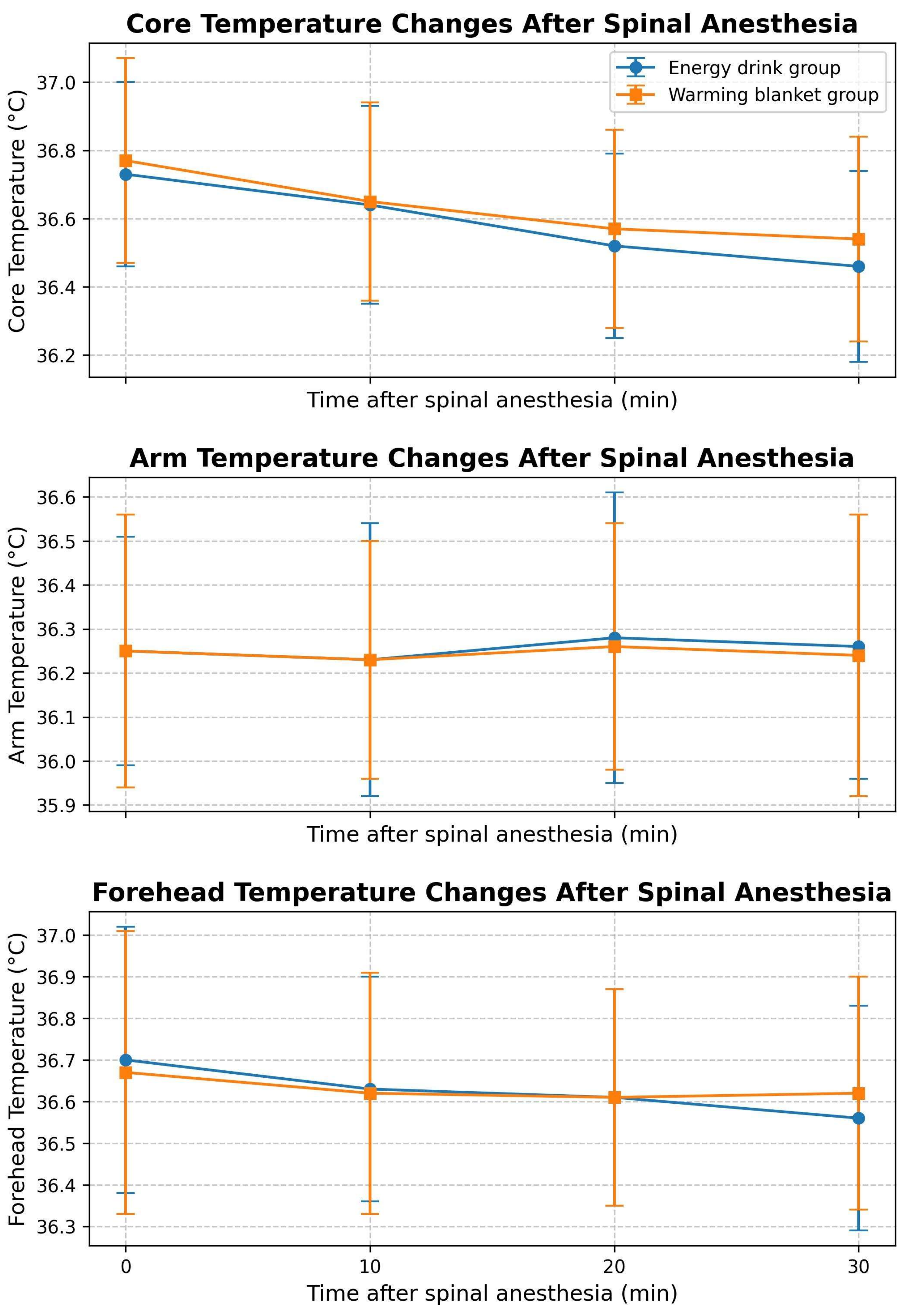
PRIMARY: Change in Core temperature intraoperative

SECONDARY: — Incidence of Hypothermia & shivering

— Maternal & neonatal safety outcomes

Results

FIGURE 1 — Core, Arm & Forehead Temperature Trends After Spinal Anesthesia (Mean $\pm$ SD)



PRIMARY OUTCOME — Non-Inferiority Established



TABLE 1 — Secondary Outcomes

Outcome	ED (n=149)	WM (n=147)	P
Hypothermia incidence	8.1%	7.5%	0.85
Shivering incidence	7.4%	12.9%	0.11
Min core temp (°C)	36.35 (36.15, 36.5)	36.4 (36.2, 36.55)	0.09
Neonatal pH (arterial)	7.32 (7.29, 7.35)	7.32 (7.29, 7.35)	0.81
1-min Apgar score	10 (10,10)	10 (9,10)	0.02
Vomiting incidence	3.4%	3.4%	0.98

Conclusions & Discussion

KEY FINDINGS

Non-inferior Efficacy: Preoperative Red Bull® (250 mL, 2 h pre-op) achieved thermoprotection equivalent to a warming mattress — median core temp drop 0.40°C vs 0.45°C; 95% CI upper limit 0.05°C < NI margin 0.10°C; P = 0.76.

Safety: No increase in maternal or neonatal adverse events including aspiration, regurgitation, or neonatal compromise.

MECHANISM

- ▶ Caffeine's thermogenic & sympathomimetic effects may raise basal metabolic heat production.
- ▶ Carbohydrate load (27 g) may be sufficient to support thermoregulation under anesthesia.

LIMITATIONS

- ▶ Open-label design; blinding not feasible.
- ▶ May not generalize to obese (BMI ≥35) or high-risk (ASA III/IV) obstetric patients.

CLINICAL IMPLICATIONS

- ▶ Low-cost, accessible thermal strategy for LMICs lacking warming equipment.
- ▶ Aligns with ERAC protocols for oral carbohydrate loading pre-Cesarean.
- ▶ May update fasting guideline for low-risk parturients.