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Propofol Dosage in Patients with Insomnia Undergoing Digestive Endoscopy: A Multi-Center Prospective Propensity Score-Matched Cohort Study

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Abstract

Background

Patients with insomnia may exhibit altered pharmacodynamics to anesthetics. This study aimed to explore the changes in propofol dosage in patients with insomnia undergoing digestive endoscopy, compared to patients with normal sleep patterns.

Methods

A multicenter prospective cohort study was conducted. Propensity score matching (1:3) was applied to balance baseline characteristics. The primary outcome was the total propofol consumption during digestive endoscopy, and gender/age/BMI subgroup analysis was performed. The secondary outcome included the propofol dosage required for successful endoscopic insertion and gender/age/BMI subgroup analysis, the recovery time, the correlation between propofol dosage requirements and insomnia severity, as well as perioperative adverse events.

Results

After matching (140 patients in the insomnia group vs 420 patients in the normal sleep group), the insomnia group required significantly higher total propofol consumption (3.8 ± 0.8 vs 3.3 ± 0.6 mg/kg, P = 0.003) and propofol dosage required for successful endoscopic insertion (2.4 ± 0.3 vs 2.1 ± 0.3 mg/kg, P = 0.043). Subgroup analyses of total propofol consumption and propofol dosage required for successful endoscopic insertion confirmed these findings across gender and age. The recovery time and the incidence of perioperative adverse events were comparable in both groups. A positive correlation was observed between propofol dosage and insomnia severity (P < 0.001).

Conclusions

Patients with insomnia require higher propofol dosages during digestive endoscopy, suggesting the need for individualized anesthesia protocols in this population.

Trial registration:

ClinicalTrials.Gov (NCT06376760, Principal investigator: Fang Luo, Date of registration: 17 April, 2024)

Background

Insomnia is the most common mental health problem in clinical practice.[1] Epidemiological studies report that the prevalence of insomnia ranges from 10% to 30%.[2–4] Because of the high incidence of insomnia, insomnia is common in patients undergoing general anesthesia.[5] If patients with insomnia are anesthetized too lightly, it can lead to intraoperative recall or awareness, and even serious psychological disorders such as anxiety, post-traumatic stress disorder (PTSD), depression and suicide.[6, 7] On the contrary, if patients with insomnia are anesthetized too deeply, it can lead to medical complications such as hypotension, depressed cardiac contractility, prolonged extubation time, and even affect the patient's postoperative recovery and discharge.[8, 9]

Cao et al. suggested that MACawake of sevoflurane was higher in women with sleep disorders undergoing breast surgery compared to those with normal sleep patterns.[10] With the advancement of modern medical level and the increased awareness and expectation of people's health care, people have more and more opportunities for examination or surgery under general anesthesia.[11] Intravenous anesthesia is more commonly used for sedation examination and treatment, therefore, the dosage in patients with insomnia undergoing digestive endoscopy with intravenous anaesthetics are worth studying.

Previously reported that preoperative sleep disturbance (defined by an Athens insomnia scale (AIS) score > 6) was associated with elevated propofol requirements in patients undergoing short-duration digestive gastroscopy; however, this single-center investigation involving 93 patients was limited by the use of AIS as a screening tool rather than a diagnostic criterion and the exclusion of the 18–44 age demographic.[12] We conducted a multicenter study with a wider age range of patients, involving a larger patient cohort, in addition to gastroscopy, also combining longer duration procedures such as colonoscopy and gastrointestinal endoscopy. The aim of our study was to explore the total propofol consumption and the propofol dosage required for successful endoscopic insertion in patients with insomnia, and to explore whether there was a correlation between propofol dosage requirements and insomnia severity.

Methods

Study design and settings

The multi-center prospective propensity score-matched (PSM) cohort study was approved by the Medical Ethics Committee of Beijing Tiantan Hospital affiliated to Capital Medical University (KY2024-091-02, President of the ethics committee: Shuping Xiao, Date of approval: April 11, 2024). The strategy was registered at ClinicalTrials.Gov (NCT06376760, Principal investigator: Fang Luo, Date of registration: 17 April, 2024). This multicenter study involved the following participating centers: Beijing Tiantan Hospital, Capital Medical University; Hebei Medical University Third Hospital; and Hengshui People's Hospital. A centralized training session was conducted for all investigators and staff from each

participating site before patient enrollment. The training covered the standard operating procedures, data collection criteria, and the proper use of equipment to minimize inter-center variability.

To ensure the robustness of this each participating center was instructed to enroll patients consecutively according to predefined inclusion and exclusion criteria, thereby minimizing selection bias and enhancing the generalizability of the findings. The study was conducted between April 2024 and October 2025. The flow chart of the study is shown in Fig. 1.

Patient population

Patients aged 18–65 years with ASA physical status I-II and BMI 15–30 kg/m² scheduled for digestive endoscopy were enrolled. The insomnia group was diagnosed according to Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria and scored ≤ 16 on the 8-item Sleep Condition Indicator (SCI).[13, 14] Insomnia screening for diagnostic purposes was performed by the anesthesiologist during the pre-anesthetic assessment as part of routine clinical care. The normal sleep group had no history of insomnia according to DSM-5 criteria and 8-item SCI. Exclusion criteria included neurological diseases, daily alcohol consumption, propofol contraindications, pregnancy or breastfeeding, sleep apnea syndrome, sleep disorders due to other causes, and acute upper respiratory infection, psychological disorders reporting suicidal thoughts,[14] need to work or take care of children/elderly people frequently at night.[12]

Intervention

A PSM (1:3) was performed based on procedure type, gender, age, BMI, and duration of procedure to balance baseline characteristics.[15] Matching was performed according to the nearest neighbor method within caliper bounds of ± 0.2 without replacement. Patients in the insomnia group were classified according to the insomnia severity index (ISI) to assess the severity of insomnia symptoms.[16, 17] Insomnia severity, as determined by the total ISI score, was categorized as follows: no clinically significant insomnia (0–7), mild insomnia (8–14), moderate insomnia (15–21), and severe insomnia (22–28). This study was divided into two groups: insomnia group and normal sleep group. The propofol was prepared by anesthesiologist A, and administered intravenously by anesthesiologist B. The sedation depth was evaluated via the Ramsay sedation scale by anesthesiologist C every 2 min.[18] The anesthesiologist B, anesthesiologist C and the gastroenterologist were blinded to the propofol dosage and patient group allocation.

Data collection and follow up

Standard monitoring including HR, BP and SpO2 was applied. The initial induction dose was 1.6 mg/kg, with subsequent boluses of 20–30 mg administered if movement or Ramsay score < 5 was observed.

Dosage was titrated using a modified Dixon's up-and-down method (MDUDM), if the previous patient showed "movement", the propofol of the next patient increased by 0.1mg/kg.[19–21] Sedation depth was assessed at 2 minute intervals to maintain a Ramsay sedation score of 5–6. The HR, BP and SpO2 were monitored continuously throughout the procedure and recovery.

All adverse events that occurred during the procedure were recorded and managed in accordance with the clinical practice. Hypoxemia was categorized into subclinical respiratory depression (90 ≤ SpO2<95%), severe hypoxia (75 ≤ SpO2<90% for at least 60 seconds, or SpO2 < 75% at any time) based on blood oxygen saturation values.[22] Hypotension was defined as BP below 30% of the baseline BP or SBP.[23] Bradycardia was defined as HR < 50 beats per minute.[24] Other adverse events such as hypertension (BP > 30% of the basal BP), arrhythmia, dizziness, agitation, nausea and vomiting, and psychiatric symptom were recorded. The recovery time referred to the time from when patients stopped intravenous injection of propofol until they could open their eyes and nod. The duration of the patients' stay in PACU were also recorded.

Study outcomes

The primary outcome was the total propofol consumption, and subgroup analyses were conducted for gender /age /BMI. Secondary outcomes included the propofol dosage required for successful endoscopic insertion and subgroup analyses across gender /age /BMI, recovery time, duration of patients' PACU stay, ease of procedure, satisfaction of gastroenterologists and patients, the correlation between propofol dosage requirement and severity of insomnia, the incidence of adverse events.

The primary and secondary outcomes of patients who deviated or discontinued from the study were retained until termination, except for patients who were unable to be assessed for total propofol consumption (primary outcome). Missing data was handled by multiple imputations to complete the data set during the whole study.

The demographic characteristics of patients included procedure type, gender, age, height, weight, ASA grade, and comorbidities such as hypertension, diabetes mellitus and coronary heart disease. Procedure related data included duration of procedure and perioperative hemodynamic parameters, etc.

After the procedure, the gastroenterologists were asked to evaluate the ease of procedure at this level of sedation (easy/medium/difficult) and the satisfaction degree of anesthesia effect (satisfactory/medium/unsatisfactory). A telephone follow-up was conducted at 24 hours after the procedure to assess the occurrence of adverse events in patients, determine their satisfaction with the procedure at the same sedation level, and inquire whether patients were willing to undergo the next procedure at the same sedation level.

Statistical Analysis

All data was performed using SPSS Statistics software. A P value < 0.05 was considered statistically significant. Normally distributed variables were presented as mean ± SD and analyzed by independent t-test. Non-normally distributed variables were presented as median and IQRs and analyzed by Mann–Whitney U-test. Categorical data was described as frequency and percentage, and analyzed by Chi-square test or Fisher's exact test. PSM was estimated by logistic regression analysis. Subgroup analyses and linear regression were used to assess correlations.

Based on a previous study suggesting a 20% increase in propofol requirement in anxious patients,[25] a sample size of 140 insomnia patients and 420 normal sleep patients was calculated to achieve 90% power at a 0.05 significance level, accounting for a 10% dropout rate. Due to the need to use PSM queue patient sampling method to conduct a 1:3 matching analysis between insomnia group and normal sleep patients, 756 normal sleep patients were included to meet the matching requirements.

Results

Baseline characteristics

After 1:3 PSM, 140 patients with insomnia and 420 patients with normal sleep patterns were well-matched between April 2024 and October 2025 (Table 1).

Table 1
Baseline data in two groups (Before PSM and After PSM)

Patients	Before PSM			After PSM		
	Insomnia Group (n = 140)	**Normal Sleep Group (n = 756)**	**P**	**Insomnia Group (n = 140)**	**Normal Sleep Group (n = 420)**	**P**
Procedure type, n (%)			0.943			0.895
Gastroscopy	50(35.7%)	261(34.5%)		50(35.7%)	159(37.9%)	
Colonoscopy	29(20.7%)	154(20.4%)		29(20.7%)	86(20.5%)	
Gastroenteroscopy	61(43.6%)	341(45.1%)		61(43.6%)	175(41.7%)	
Age (years, mean ± SD)	47.9 ± 10.8	51.1 ± 9.6	**0.001**	47.9 ± 10.8	49.3 ± 10.2	0.151
Gender, male (%)	49(35.0%)	333(44.0%)	**0.047**	49(35.0%)	146(34.8%)	0.959
BMI (mean ± SD)	23.9 ± 3.0	24.4 ± 3.1	0.855	23.9 ± 3.0	24.4 ± 2.8	0.386
Comorbidities, n (%)						
Hypertension	34(24.3%)	172(22.8%)	0.692	34(24.3%)	89(21.2%)	0.444
Diabetes mellitus	28(20.0%)	102(13.5%)	**0.045**	28(20.0%)	66(15.7%)	0.240
Coronary disease	16(11.4%)	30(4.0%)	**< 0.001**	16(11.4%)	26(6.2%) 35(5.0%)	**0.042**
Stroke	15(10.7%)	44(5.8%)	**0.032**	15(10.7%)	31(7.4%)	0.214
Allergy	22(15.7%)	62(8.2%)	**0.005**	22(15.7%)	40(9.5%)	**0.043**
Smoke	25(17.9%)	89(11.8%)	**0.047**	25(17.9%)	51(12.1%)	0.087
Drink	28(20.0%)	86(11.4%)	**0.005**	28(20.0%)	54(12.9%)	**0.038**

Efficacy Outcomes

Total propofol consumption and subgroup analysis

After PSM, the total propofol consumption during digestive endoscopy was significantly higher in the insomnia group than in the normal sleep group (3.8 ± 0.8 vs. 3.3 ± 0.6 mg/kg; MD = 0.5 mg/kg, 95% CI [-0.6, -0.4], p = 0.003) (Fig. 2).

The heterogeneity test results indicated that $\chi^2 = 6.00$, degree of freedom = 5 (P = 0.31), and $I^2 = 17\%$ (Fig. 3). In the male/female/young/middle-aged/normal weight/overweight subgroups, patients in the insomnia group required significantly higher doses of propofol than those in the normal sleep group (all P values < 0.05). Furthermore, the interaction test showed that the P for interaction between insomnia and propofol dosage in different genders, ages, and BMI subgroups were 0.536, 0.891, and 0.013 (Fig. 4), respectively. Specifically, the increase in propofol requirement associated with insomnia was greater in normal-weight patients (MD = 0.7, 95% CI: 0.5–0.9) compared to overweight patients (MD = 0.3, 95% CI: 0.1–0.5).

The propofol dosage required for successful endoscopic insertion and subgroup analysis

The propofol dosage required for successful endoscopic insertion was significantly higher in the insomnia group than in the normal sleep group (2.4 ± 0.3 vs. 2.1 ± 0.3 mg/kg; MD = − 0.3 mg/kg, 95% CI [− 0.4, − 0.3], p = 0.043) (Fig. 2).

The heterogeneity test results indicated that $\chi^2 = 0.00$, degree of freedom = 5 (P = 1.00), and $I^2 = 0\%$ (Fig. 6). In the male/female/young/middle-aged/normal weight/overweight subgroups, patients in the insomnia group required significantly higher doses of propofol than those in the normal sleep group (all P values < 0.05). Furthermore, the interaction test showed that the P for interaction between insomnia and propofol dosage required for successful endoscopic insertion in different genders, ages, and BMI subgroups were 0.416, 0.317, and 0.977 (Fig. 7), respectively.

The duration of procedure, recovery time and the duration of patients' PACU stay

No statistically significant differences were observed in the duration of procedure, recovery time, and the duration of patients' PACU stay between the insomnia and normal sleep groups. Specifically, the duration of procedure was 22.4 ± 10.0 min in the insomnia group compared to 22.4 ± 10.0 min in the normal sleep group (P = 0.857). Recovery time did not differ significantly between the two groups (6.6 ± 1.4 min vs. 7.1 ± 4.8 min; mean difference, − 0.5 min; 95% CI, − 0.4 to 1.2; P = 0.247). Similarly, the duration of patients' PACU stay was comparable (28.9 ± 3.1 min vs. 29.1 ± 2.8 min; mean difference, − 0.2 min; 95% CI, − 0.3 to 0.8; P = 0.078).

The satisfaction

Both groups exhibited high satisfaction rates (> 95%) without intergroup differences (P > 0.05) (Fig. 8). In contrast, the patients' satisfaction with the procedure at this level of sedation and patients' willingness to undergo the next procedure at the same sedation level were higher than 98%, and there was no statistical difference between the two groups (Fig. 8).

Patient characteristics in insomnia group

The basic data of the patients in insomnia group were listed in Table 2. No statistically significant differences were observed in the duration of procedure, recovery time, and the duration of patients' PACU stay among severity subgroups (P > 0.05). In the insomnia group, mild insomnia accounted for 52.9%, moderate insomnia accounted for 32.1%, and severe insomnia accounted for 15.0%. ISI scores differed significantly among severity subgroups (P < 0.001).

Table 2
Baseline data in patients with insomnia

Patients with Insomnia	**Mild (n = 74)**	**Moderate (n = 45)**	**Severe (n = 21)**	**P**
Procedure type, n (%)				0.099
Gastroscopy	32(43.2%)	11(24.4%)	7(33.3%)	
Colonoscopy	17(23.0%)	10(22.2%)	2(9.5%)	
Gastroenteroscopy	25(33.8%)	24(53.3%)	12(57.1%)	
Age (years, mean ± SD)	44.1 ± 10.9	44.4 ± 12.3	43.5 ± 10.3	0.956
Gender, male (%)	26(35.1%)	13(28.9%)	10(47.6%)	0.331
BMI (mean ± SD)	24.0 ± 3.1	23.6 ± 2.8	24.3 ± 2.9	0.674
Comorbidities, n (%)				
Hypertension	18(24.3%)	11(24.4%)	5(23.8%)	0.998
Diabetes mellitus	15(20.3%)	11(24.4%)	2(9.5%)	0.368
Coronary disease	9(12.2%)	4(8.9%)	3(14.3%)	0.781
Stroke	8(10.8%)	5(11.1%)	2(9.5%)	0.981
Allergy	10(13.5%)	7(15.6%)	5(23.8%)	0.519
Smoke	16(21.6%)	8(17.8%)	1(4.8%)	0.205
Drink	13(17.6%)	9(20.0%)	6(28.6%)	0.539
The duration of insomnia (months, median (interquartile range))	48(24–84)	60(27–84)	60(42–90)	0.837
SCI Score (mean ± SD)	7.3 ± 0.9	4.7 ± 0.8	2.6 ± 0.7	**< 0.001**
ISI Score (mean ± SD)	10.6 ± 1.8	17.0 ± 1.7	24.2 ± 1.2	**< 0.001**

The correlation between propofol dosage and insomnia severity

In the insomnia group, the total consumption of propofol was increased by 6.1% in patients with mild insomnia, 24.2% in those with moderate insomnia, and 36.4% in those with severe insomnia, compared to patients with normal sleep. The correlation coefficient between insomnia severity and the total consumption of propofol was 0.564 (95% CI: 0.428 to 0.683). The correlation coefficient between insomnia severity and the propofol dose required for successful endoscopic insertion was 0.375 (95% CI: 0.200 to 0.500). A significant correlation was found between the total consumption of propofol and insomnia severity ($P < 0.001$, adjusted $R^2 = 0.310$) (Table 3). Similarly, the propofol dose required for successful endoscopic insertion also correlated with insomnia severity ($P < 0.001$, adjusted $R^2 = 0.082$) (Table 3).

Table 3
Regression analysis between average_propofol dosage/average propofol dosage required for successful endoscopic insertion and insomnia severity.

		Unstandardized coefficients		Standardized coefficients			
		B	SE	ß	t	P	VIF
Average propofol dosage	**Constant**	2.909	0.128		22.755	< 0.001	
	Insomnia severity	0.573	0.072	0.562	7.973	< 0.001	1.000
Average propofol dosage required for successful endoscopic insertion	**Constant**	2.226	0.060		37.361	< 0.001	
	Insomnia severity	0.123	0.033	0.298	3.665	< 0.001	1.000

Perioperative adverse events

There were 15 patients (10.7%) in the insomnia group, while 53 patients (12.6%) in the normal sleep group experienced subclinical respiratory depression ($P = 0.550$). Additionally, one patient (0.7%) in the insomnia group and four patients (1.0%) in the normal sleep group experienced severe intraoperative hypoxia ($P = 0.633$). The incidence of intraoperative hypotension in patients with insomnia and patients with normal sleep was 28.6% and 27.1%, respectively, with no statistically significant difference ($P = 0.741$).

The incidence of other adverse events was similar between the two groups, such as hypertension, arrhythmia, dizziness, agitation, nausea, vomiting and intraoperative awareness. In the insomnia group, no patients suffered from psychiatric symptom; and in the normal sleep group, one patient suffered from

psychiatric symptom, accounting for 0.2%. The incidence of perioperative complications was shown in Fig. 9. These short-term perioperative complications gradually returned to normal within 2 to 3 days.

Discussion

In this multi-center prospective PSM cohort study, although 336 patients in the normal-sleep group were excluded from the matched cohort after PSM, this exclusion did not compromise the internal validity of the study findings. We found that the average total propofol consumption in the insomnia group was higher than that in normal sleep group during digestive endoscopy. In our study, compared to the normal sleep group, the average total propofol consumption in the insomnia group increased by 15.2%, the average dosage of propofol for successful insertion of digestive endoscope increased by 14.3%. This was consistent with the research findings of Qiu et al.,[12] which confirmed that patients with preoperative sleep disturbance did indeed require higher Cp and the infusion rate per body surface area of propofol to achieve satisfactory anesthesia effects during degestive gastroscopy.[12] Unlike Qiu et al., our multicenter, large-scale study provides higher-level evidence. Furthermore, while Qiu et al. included patients evaluated for sleep disturbance, our study enrolled patients with confirmed insomnia diagnosis. Additionally, our inclusion criteria extended the age range to 18–65 years, adding an age group of 18–44 years old. Finally, in addition to gastroscopy, we also included patients undergoing longer-duration procedures such as colonoscopy or gastrointestinal endoscopy, whereas their study was limited to relatively short-duration gastroscopy. However, the average difference in the total dose of propofol between the insomnia group and the normal sleep group was only 0.5 mg/kg, which was related to the small total consumption of propofol during digestive endoscopy. Although the clinical significance of this difference may not be significant, this study can at least suggest that preoperative anesthesia evaluation should attach importance to sleep quality, providing a theoretical basis for individualized dose adjustment of propofol and precise anesthesia management in patients with insomnia.

The low heterogeneity of our study enhanced the reliability of the findings, indicating that the impact of insomnia on propofol requirements may be generalizable across different populations. Analyses across gender and age subgroups consistently demonstrated that patients with insomnia required a significantly higher total dosage of propofol, thereby confirming the robustness of the primary outcome concerning the influence of insomnia on propofol requirements, irrespective of patient sex or age. However, the magnitude of insomnia's effect on propofol dosage varied significantly among patients with different BMI, suggesting that BMI may act as an effect modifier. This interaction was potentially attributable to the fact that overweight itself could alter the pharmacokinetics and pharmacodynamics of propofol, which might attenuate the additional impact of insomnia. Consequently, the stability of the primary outcome across different BMI categories appeared somewhat less consistent. Besides, analyses across gender, age and BMI subgroups consistently demonstrated that patients with insomnia required a significantly higher propofol dosage required for successful endoscopic insertion, irrespective of patient sex, age or BMI. However, subgroup analysis still emphasized that insomnia should be

regarded as an important factor influencing propofol consumption during digestive endoscopy, regardless of the basic demographic characteristics of the patients.

Adjusting the dose of propofol on the basis of MDUDM can meet the requirements of digestive endoscopy for both groups of patients without increasing the difficulty of digestive endoscopy. Despite the dose of propofol being increased, patients with insomnia reported comparable satisfaction with the procedure at this level of sedation and willingness to undergo the next procedure at the same sedation level. Similarly, although the total consumption of propofol was higher in the insomnia group, the recovery time and PACU hospital stay of the two groups of patients were comparable. The research results show that patients with insomnia need a higher dose of propofol to achieve the same anesthetic effect as those with normal sleep.

In our study, insomnia severity accounted for approximately 31.0% of the variance in total propofol consumption. This meant that 31.0% of the variance in the total propofol consumption were caused by variance in insomnia severity. The remaining variance was likely attributable to other factors, such as individual sensitivity, metabolic differences, the specific type of endoscopic procedure performed, and the technique of the gastroenterologists. However, insomnia severity had a relatively weak explanatory power, accounting for approximately 8.2% of the variance in the propofol dosage required for successful endoscopic insertion. This meant that 8.2% of the variance in the propofol dosage required for successful endoscopic insertion were caused by variance in insomnia severity. This suggested the presence of more dominant confounding factors, such as the intensity of transient procedural stimulation and the technique of the gastroenterologists.

In our study, the incidence rates of perioperative adverse events were similar between the two groups, indicating that although patients with insomnia required higher doses of propofol to achieve the satisfied depth of anesthesia, the wide treatment window of propofol and the possible compensatory mechanism of the body did not significantly increase adverse events. This was consistent with the findings of Wadhwa et al., which suggested that the difference in propofol dosage was not directly related to the incidence of intraoperative hypoxemia.[26]

One of the key pathophysiological mechanism underlying insomnia may involve dysregulation of the GABA system, a primary inhibitory neurotransmitter in the central nervous system.[27] Evidence suggests that patients with insomnia often exhibit reduced GABAergic tone or altered GABA-A receptor sensitivity in key brain regions governing sleep-wake cycles.[28, 29] This impairment in inhibitory signaling is thought to contribute to the state of hyperarousal characteristic of the disorder. Propofol, an intravenous anesthetic, primarily exerts its sedative-hypnotic effects by potentiating GABAergic inhibition through GABA-A receptors.[30, 31] Consequently, the diminished baseline GABAergic function in patients with insomnia may necessitate a higher propofol dosage to achieve the same level of receptor activation and therapeutic sedation effect.[28, 29] This rationale is further supported by findings that chronic sleep deprivation can alter GABA-A receptor subunit composition, potentially reducing propofol's efficacy.[28, 32]

Several limitations should be acknowledged in this study. Firstly, although patients were evaluated for insomnia based on DSM-5 criteria and self-rating scales such as SCI and ISI scores, there was a lack of objective evaluation criteria including polysomnography. Secondly, we only included patients aged 18–65 years with ASA physical status I-II and BMI of 15–30 kg/m2. This limited the generalizability of our research results to clinically complex patient populations such as the elderly population over 65 years old, patients with high ASA status (III-IV), and patients with extreme BMI (< 15 or > 30 kg/m2). Thirdly, the study was restricted to digestive endoscopy due to its short procedure duration, minimal stimulation, and limited confounding factors. It is necessary to conduct research on general anesthesia intubation for major surgeries in the future to validate and expand these preliminary results. Fourthly, as unmeasured center specific factors may affect treatment allocation or outcomes, center missing as a fixed covariate was a limitation. Future studies with larger sample sizes across more centers are warranted to further validate these observations. Fifth, given the large number of secondary endpoints and safety comparisons across multiple adverse event categories, the possibility of Type I error inflation due to multiple testing should be acknowledged. Furthermore, the magnitude of increased propofol dosage requirements observed in patients with insomnia warrants validation through randomized controlled trials to provide robust evidence-based support.

In conclusion, Patients with insomnia may require higher propofol dosages during digestive endoscopy, suggesting the need for individualized anesthesia protocols in this population.

Abbreviations

PTSD
post-traumatic stress disorder
AIS
Athens insomnia scale
PSM
Propensity Score Matching
ASA
American society of Anesthesiologists
BMI
Body Mass Index
DSM-5
Diagnostic and Statistical Manual of Mental Disorders,Fifth Edition
SCI
Sleep Condition Indicator
ISI
Insomnia Severity Index
HR
heart rate
BP

blood pressure
SpO2
pulse oximetry
SD
standard deviation
IQRs
interquartile ranges
RCT
randomized controlled trials.

Declarations

Conflict of interest:

none

Ethics approval and consent to participate

Approval of this study is granted by the Medical Ethics Committee of Beijing Tiantan Hospital affiliated to Capital Medical University (Reference number: KY2024-091-02).

Consent for publication

Not applicable

Competing interests

All other authors declare that they have no competing interests.

Average propofol dosage required for successful endoscopic insertion across gender/age/BMI subgroup

was shown in (A), (B), (C). Notes: Data are presented as mean ± SEM. Error bars indicate ± SEM. Sample sizes: Male (Insomnia, n = 49; Normal sleep, n = 146), Female (Insomnia, n = 91; Normal sleep, n = 274). Young (Insomnia, n = 59; Normal sleep, n = 159), Middle-aged (Insomnia, n = 81; Normal sleep, n = 261). Normal weight (Insomnia, n = 82; Normal sleep, n = 232), Overweight (Insomnia, n = 57; Normal sleep, n = 186). *P < 0.05, **P < 0.01, ***P < 0.001 was considered as statistically significant compared with normal sleep group.

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Author Contribution

Z.S. is responsible for the study concept and design, acquisition of data, analysis and interpretation, drafting the manuscript. C. W. and Y. C. are responsible for acquisition of data and critical revision of the manuscript for important intellectual content. L. l. ,H. C. and F. L. are responsible for study concept and design, critical revision of the manuscript for important intellectual content, supervision. All authors reviewed and approved the final version of the manuscript to be published.

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Not applicable

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request. Due to patient privacy restrictions and ethical approval constraints (Ethics Committee of Beijing Tiantan Hospital), the data are not publicly available and require a formal request with approval from the relevant institutional review board.

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Figures

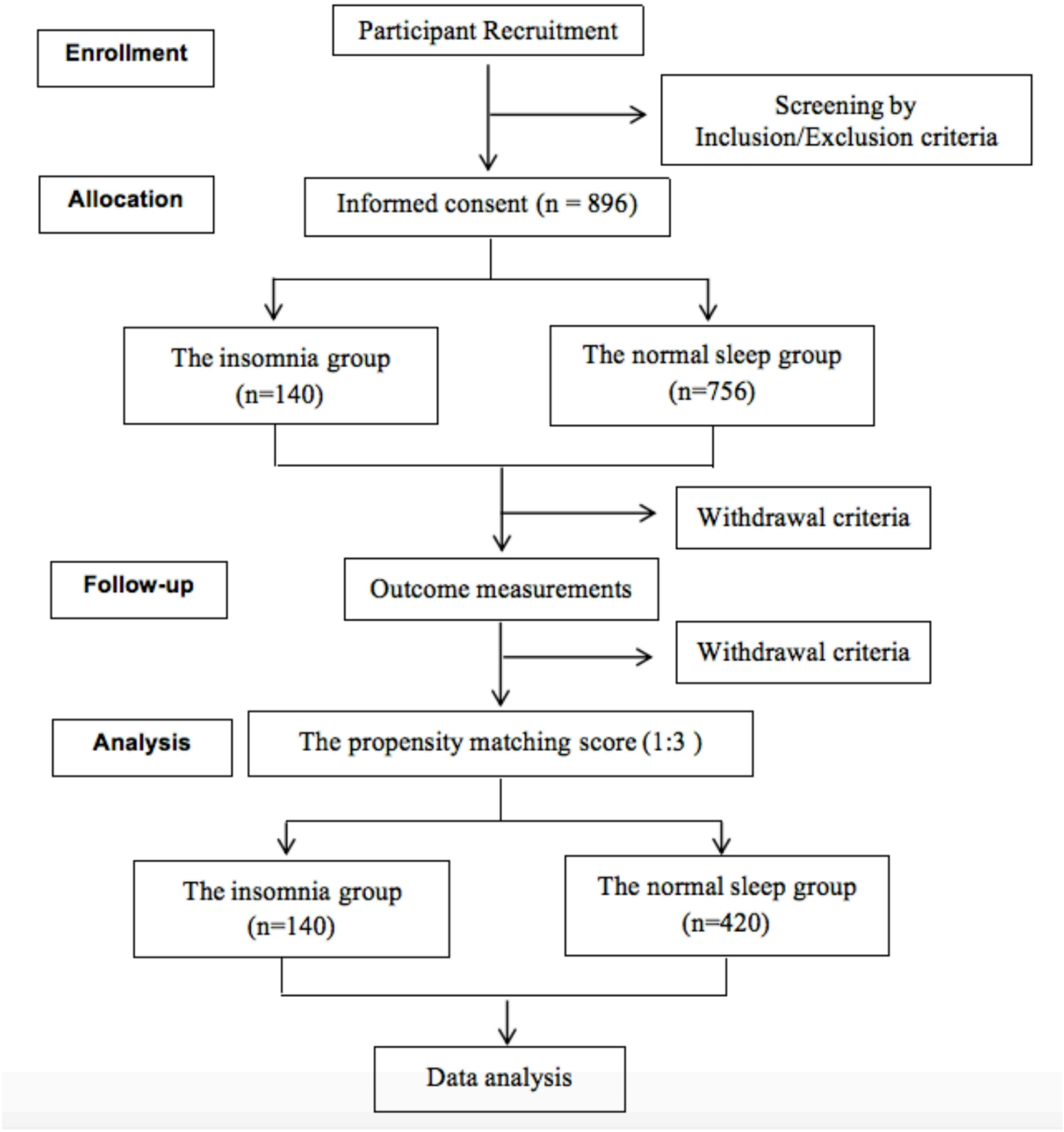


Figure 1

The flowchart of the study.

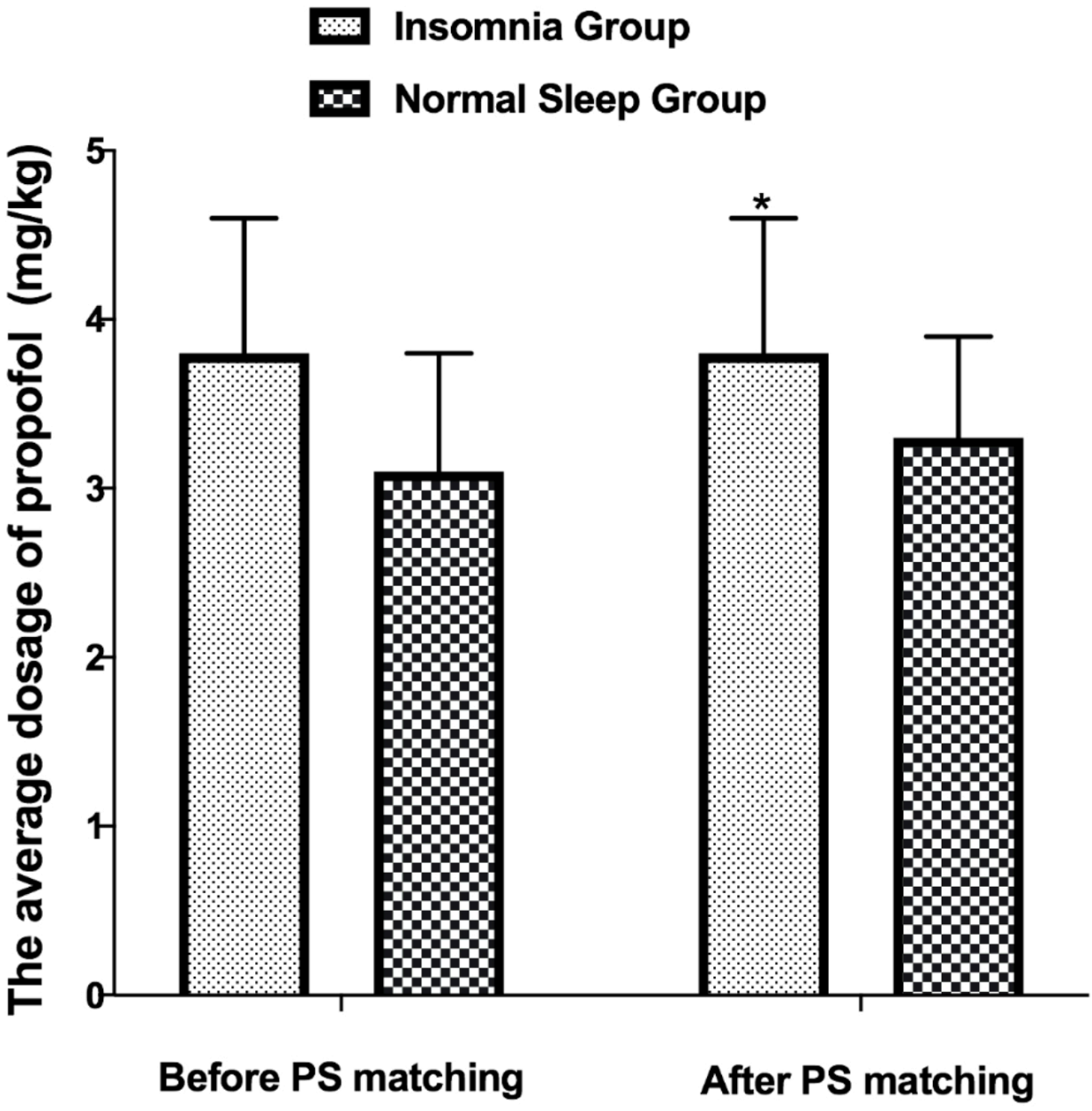


Figure 2

The total propofol consumption during digestive endoscopy in two groups.

Notes: Data are presented as mean ± SD. *P < 0.05 was considered as statistically significant compared with normal sleep group.

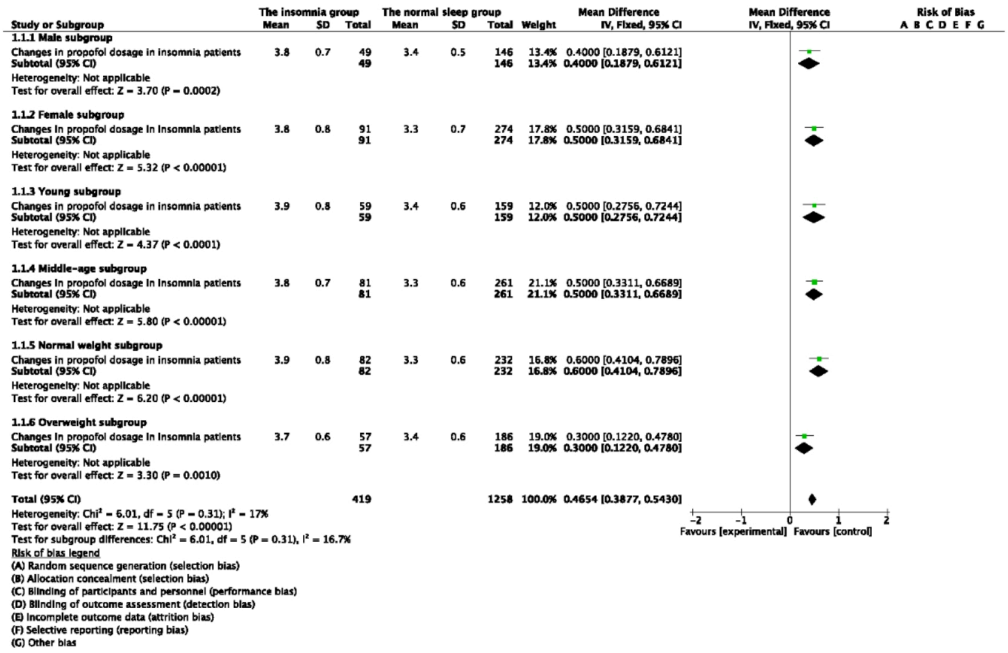


Figure 3

Forest plot of the difference in total propofol consumption between patients with insomnia and normal sleep during digestive endoscopy, by subgroups.

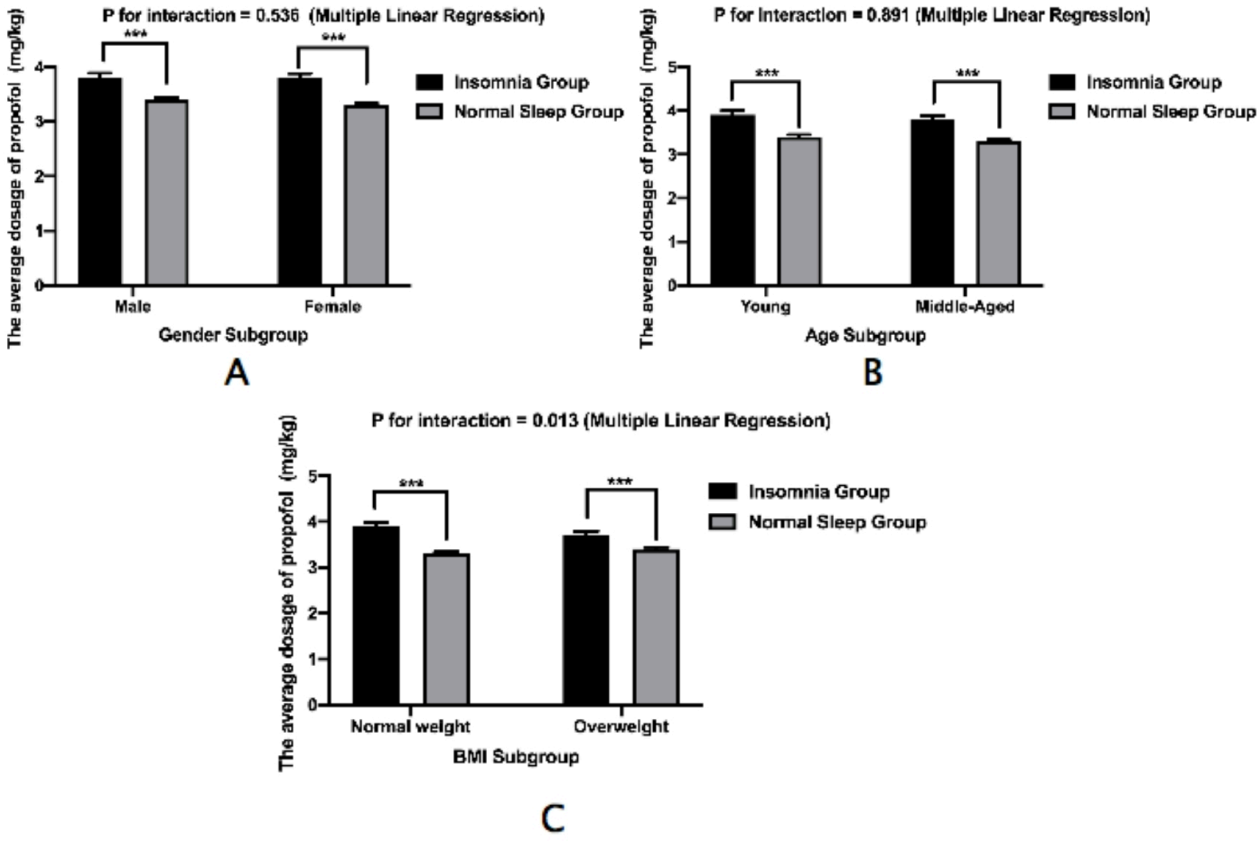


Figure 4

Interaction plot of total propofol consumption.

Average propofol dosage across gender/age/BMI subgroup was shown in (A), (B), (C). Notes: Data are presented as mean ± SEM. Error bars indicate ± SEM. Sample sizes: Male (Insomnia, n = 49; Normal sleep, n =146), Female (Insomnia, n = 91; Normal sleep, n = 274). Young (Insomnia, n = 59; Normal sleep, n = 159), Middle-aged (Insomnia, n = 81; Normal sleep, n = 261). Normal weight (Insomnia, n = 82; Normal sleep, n = 232), Overweight (Insomnia, n = 57; Normal sleep, n =186). *P < 0.05, **P < 0.01, ***P < 0.001 was considered as statistically significant compared with normal sleep group.

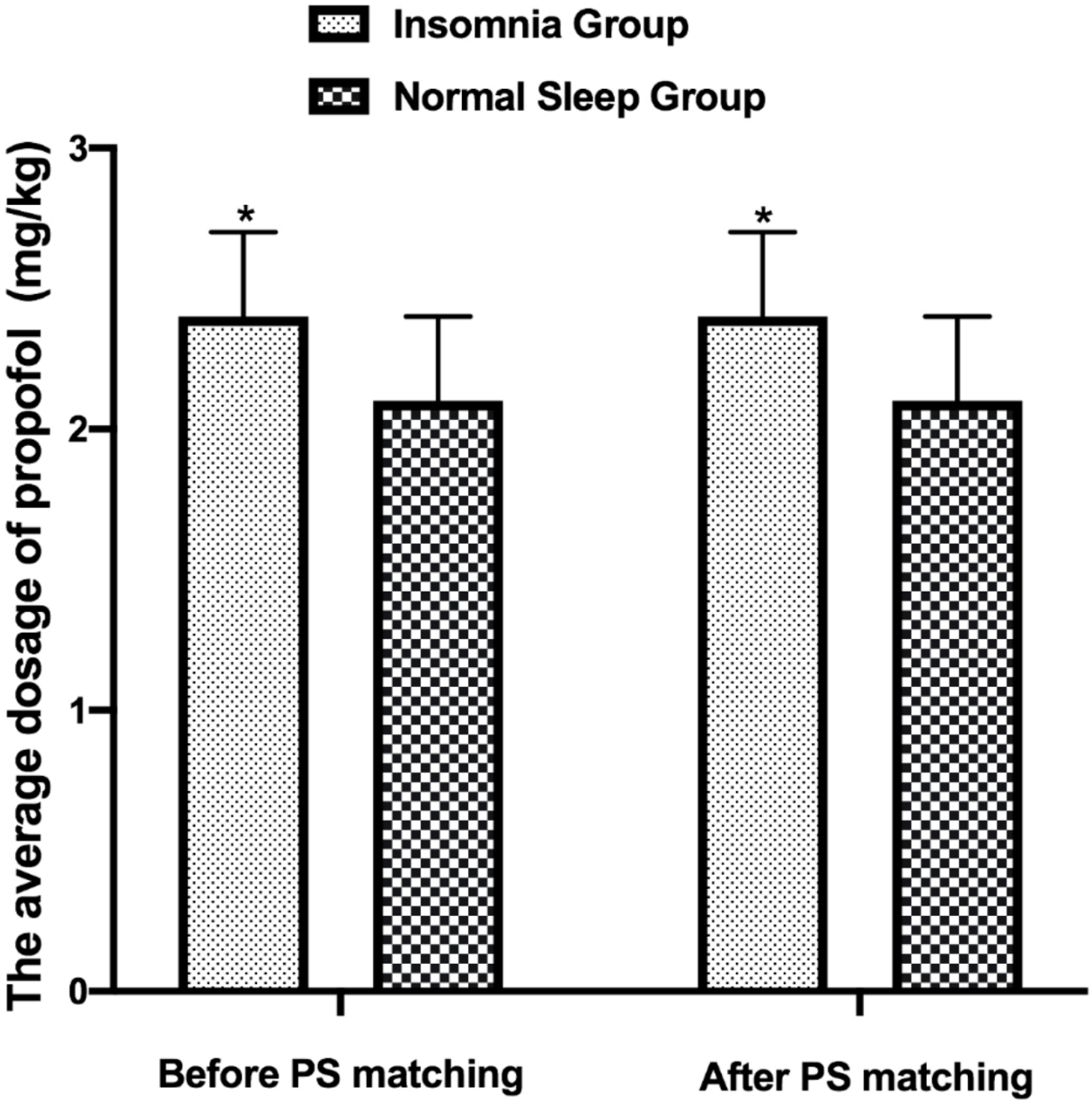


Figure 5

The propofol dosage required for successful endoscopic insertion in two groups.

Notes: Data are presented as mean ± SD. *P < 0.05 was considered as statistically significant compared with normal sleep group.

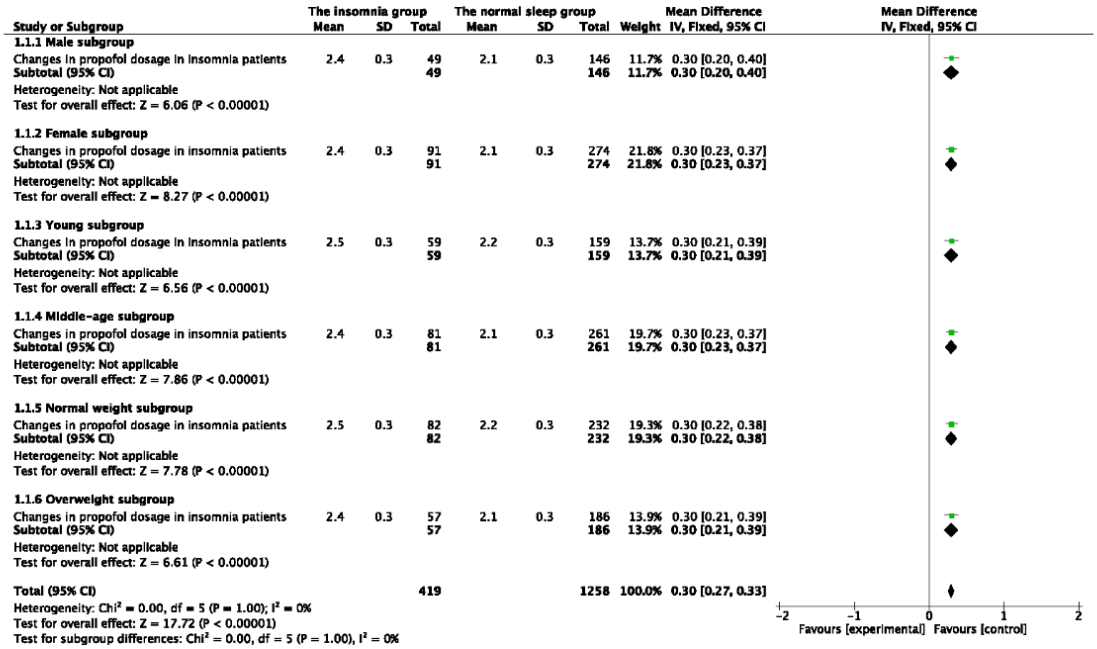


Figure 6

Forest plot of the difference in propofol dosage required for successful endoscopic insertion between patients with insomnia and normal sleep during digestive endoscopy, by subgroups.

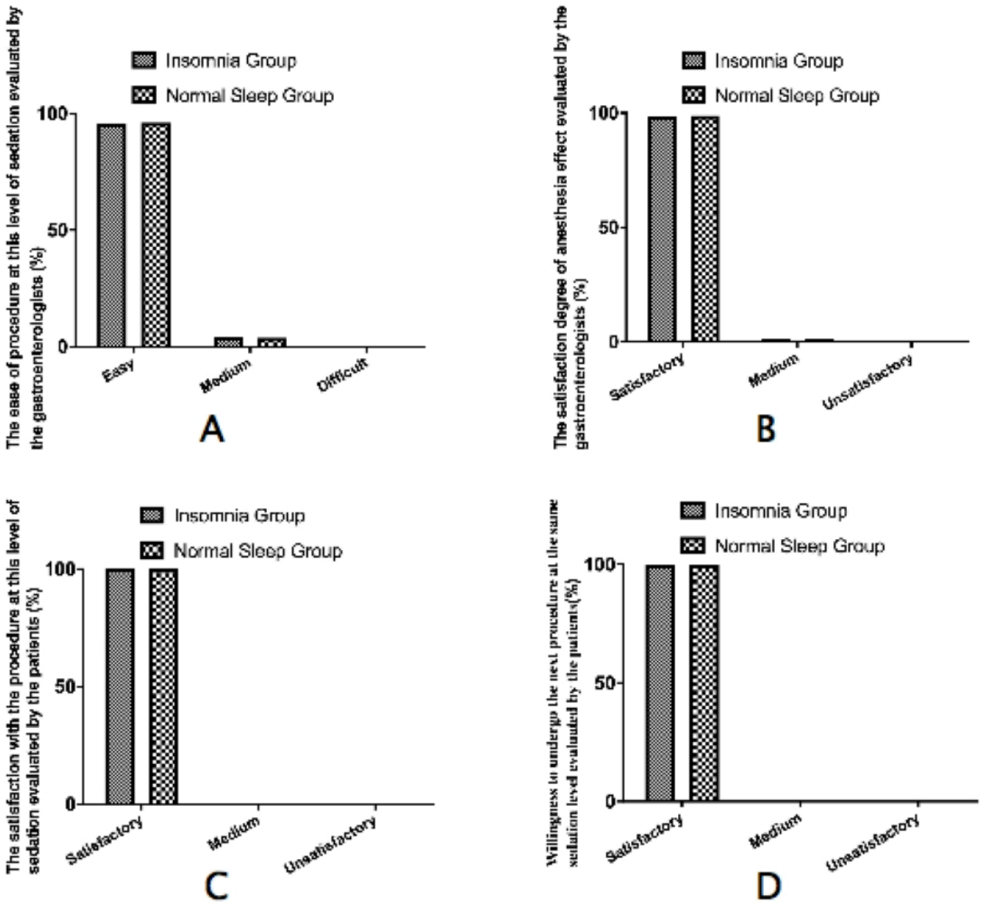


Figure 7

The ease of procedure at this level of sedation evaluated by the gastroenterologists was shown in (A). The satisfaction degree of anesthesia effect evaluated by the gastroenterologists was shown in (B). The patients' satisfaction with the procedure at this level of sedation was shown in (C). The patients' willingness to undergo the next procedure at the same sedation level was shown in (D).

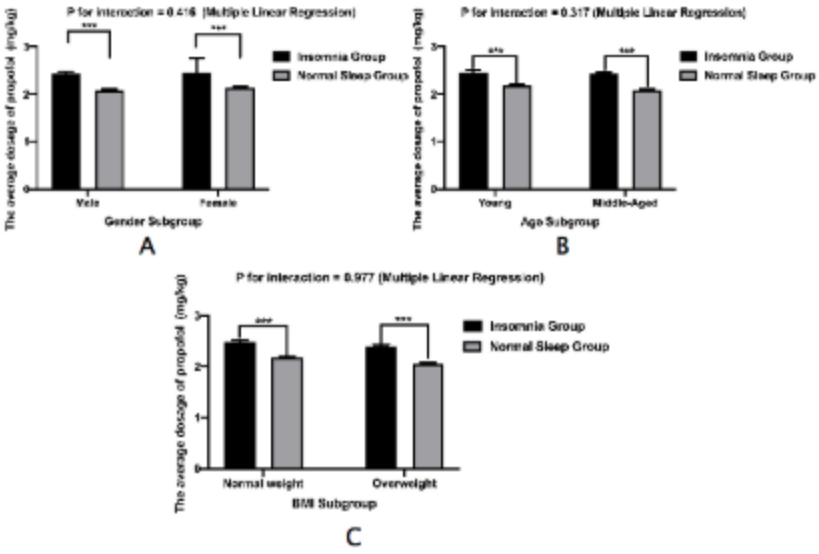


Figure 8

Interaction plot of the propofol dosage required for successful endoscopic insertion.

Average propofol dosage required for successful endoscopic insertion across gender/age/BMI subgroup was shown in (A), (B), (C). Notes: Data are presented as mean ± SEM. Error bars indicate ± SEM. Sample sizes: Male (Insomnia, n = 49; Normal sleep, n =146), Female (Insomnia, n = 91; Normal sleep, n = 274). Young (Insomnia, n = 59; Normal sleep, n = 159), Middle-aged (Insomnia, n = 81; Normal sleep, n = 261). Normal weight (Insomnia, n = 82; Normal sleep, n = 232), Overweight (Insomnia, n = 57; Normal sleep, n =186). *P < 0.05, **P < 0.01, ***P < 0.001 was considered as statistically significant compared with normal sleep group.

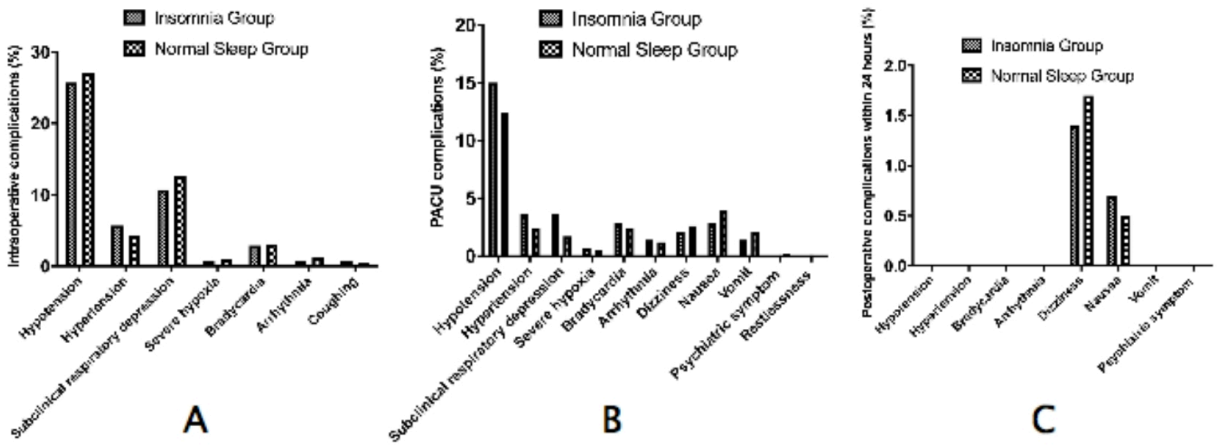


Figure 9

The incidence of perioperative complications in two groups. Intraoperative complications were shown in (A). PACU complications were shown in (B). Postoperative complications within 24 hours were shown in (C).