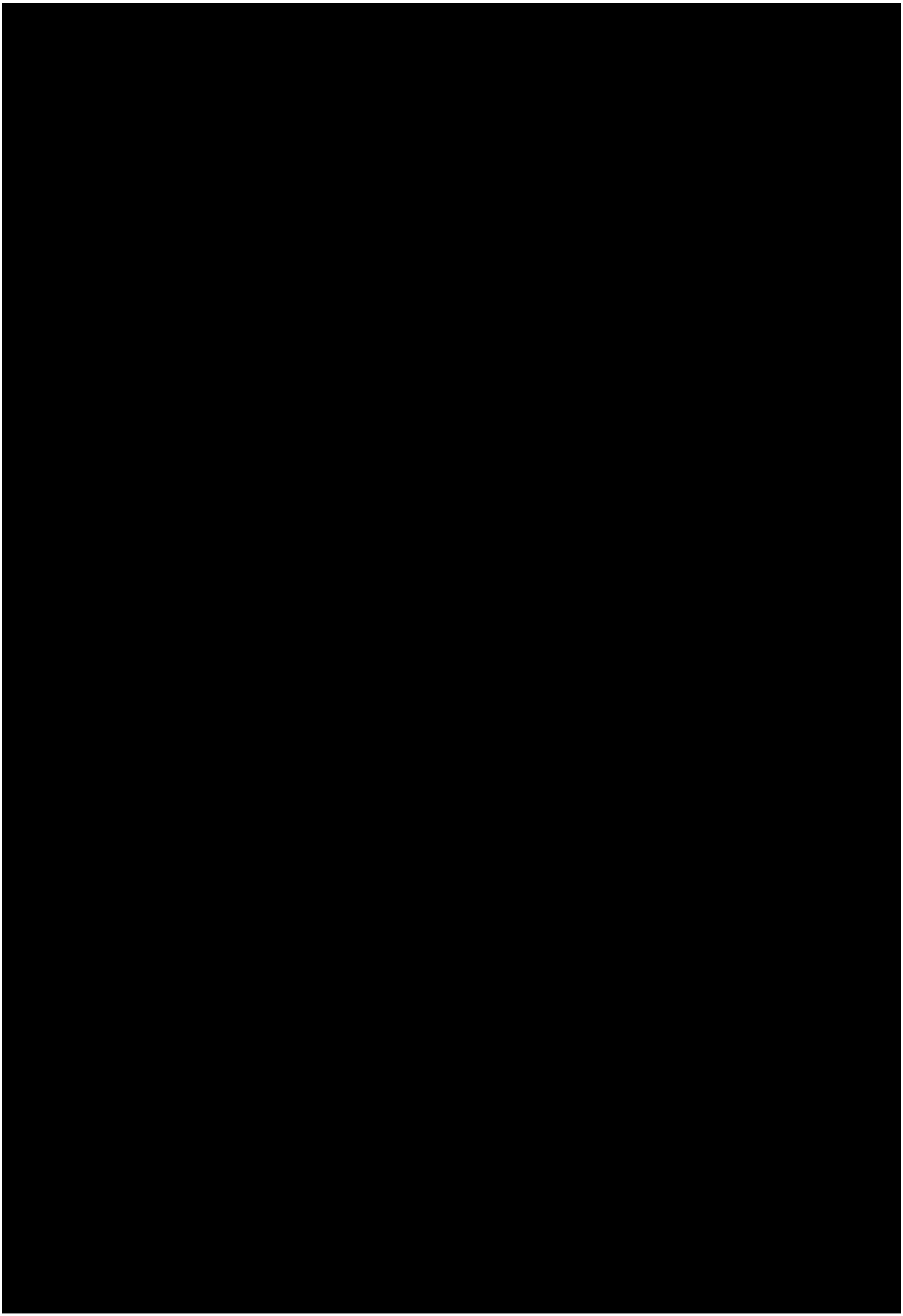

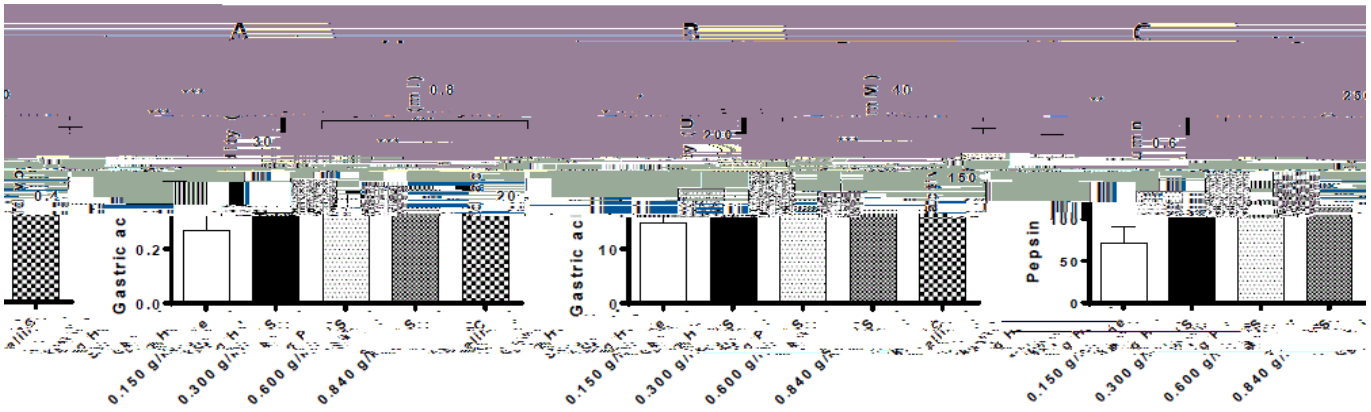

Figure 2: *Herba Swertiae* enhances the secretion of gastric acid (A) and inceases the acidity of gastric acid (B) and the acitivity of pepsin (C) in rats.

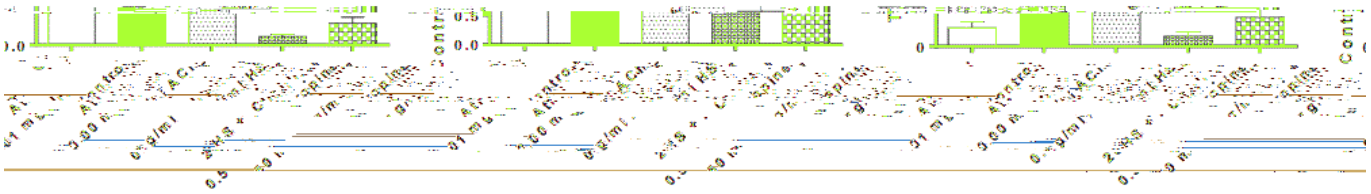

Figure 3: *Herba Swertiae* increases the mobility of ileum with a increase in the muscular tension force (A), contraction amplitude (B) and contraction frequency (C).

system *in vivo*, we performed *ex vivo* study to test the e ect of *Herba Swertiae* on isolated ileum of guinea pig with a focus on muscular tension force, contraction amplitude and frequency. Treatment of guinea pig with 20 mg/ml *Herba Swertiae* enhanced the muscular tension force, contraction amplitude and frequency in isolated ileum (Figures 3A-3C). Compared to the control group, *Herba Swertiae* (20 mg/ml × 2 ml) increased 2.2-fold in the muscular tension force ($P < 0.05$; Figure 3A); ACh (0.01 mg/ml × 0.1 ml) enhanced 8.5-fold in the muscular tension force ($P < 0.001$; Figure 3A); atropine (0.5 mg/ml × 0.4 ml) decreased 45.2% in the muscular tension force ($P > 0.05$; Figure 3A). Of note, *Herba Swertiae* restored atropine-minished muscular tension force with 2.9-fold increase, compared to atropine-treated alone ($P < 0.05$; Figure 3A). For the contraction amplitude, *Herba Swertiae* treatment resulted in a signi cant increase with 2.9-fold ($P < 0.001$), whereas atropine treatment led to a 81.1% decrease ($P < 0.05$), compared to the control group (Figure 3B). *Herba Swertiae* antagonized atropine-reduced contraction amplitude with 2.5-fold increase, compared to atropine-treated alone ($P > 0.05$; Figure 3B). In addition, although there was slight increase in the contraction frequency in the isolated ileum when treated with ACh and *Herba Swertiae*, there was no signi cant alteration ($P > 0.05$, Figure 3C). However, atropine dramatically increased the contraction frequency 49.6-fold ($P < 0.001$; Figure 3C). Notably, *Herba Swertiae* abolished the increasing e ect of atropine on contraction frequency and normalized it (Figure 3C). In aggregate, *Herba Swertiae* exerts a bene cial e ect on the mobility of ileum.

D

A large line of evidence shows that herbal medicines and natural products have been the most productive source for the drug discovery and development and there is a wealth of evidence showing the application of herbal medicines and natural products for body function management and aliments treatment [1,2,4,9,10]. Owning to the multiple bioactive components in herbal medicines and natural products, it can explain the multiple targets e ect in their medical applications; on the other hand, it may contribute to the unwanted side e ects. erefore, it needs to fully evaluate the bene cial e ect and side e ect of herbal medicines and natural products to improve their therapeutic e ect and avoid unfavorable e ect in clinical practice.

Herba Swertiae is traditionally used for the treatment of diarrhea, poor appetite, hypochondriac pain, and jaundice that can be ascribed to the mechanism of actions of the clearance of damp-heat and the strengthening of the stomach [6,7]. In the present study, we observed potent bene cial e ects of *Herba Swertiae* on gastrointestinal system *in vivo*. In clinical settings, the aberrations in gastric emptying and intestinal propulsion are the common causes to gastrointestinal disorders [11,12]. Our study showed a promoting e ect of *Herba Swertiae* on gastric emptying and intestinal propulsion in mice, which is similar to the e ect of domperidone. It has been demonstrated that domperidone stimulates gastric muscle contraction by antagonizing the inhibitory e ects of dopamine on postsynaptic cholinergic neurons

[13]. erefore, our ndings suggest that *Herba Swertiae* may exert similar e ect to domperidone on gastrointestinal system via its multiple active components; however, it needs to be further validated in future studies regarding the underlying mechanisms and molecular targets for bene cial e ect on the gastrointestinal system.

Furthermore, our ndings showed that *Herba Swertiae* dose-dependently enhanced the secretion and the acidity of gastric acid and the activity of pepsin in rats. Such increasing e ect is comparable to that of the positive control, which renders *Herba Swertiae* may be a potent . epy be .(en-GB)/MayLaw -46.54 1e co