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# Effect of Different Varieties on Growth and Yield of Maize (*Zea mays* L.) under Gird Region of Madhya Pradesh

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

The present investigation was conducted at field of School of Agriculture science, Vikrant University, Gwalior, (M.P.). Maize (*Zea mays* L.) is one of the important cereal crops belong to the *Poaceae* family, which ranked third after wheat and rice crops in of the productivity and cultivated area in the world. It is a short duration, quick growing and widely grown crop with high potential, there are no cereal crops with such an immense potentiality, so it is called as "queen of cereals". Different varieties of maize e.g., JM 218, JM 215, PRMH-306, JM-8, JM-13 are grown. The medium or late maturing varieties suffer due to water stress at maturity stage and lack of suitable varieties with stress tolerance at various stages of growth is one of the limiting factors. The experiment was laid out in Randomized Block Design (RBD) with three replications. Each replication was comprised of six treatments involving different varieties i.e. JM218, JM215, PRMH – 306, JM – 8 and JM – 13

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of maize. Result concluded that the varieties PRMH – 306 ($T_3$) may be more beneficial in terms of growth, productivity, and profitability over rest of the treatments, which suggests that the varieties PRMH – 306 is more scientific management for under field condition as well as sandy loam soil for maize in region of Madhya Pradesh.

*Keywords: Cereal crops; agronomic practices; maize variety; stress tolerance.*

## 1. INTRODUCTION

Maize (*Zea mays* L.) is one of the important cereal crops belong to the Poaceae family, which ranked third after wheat and rice crops in of the productivity and cultivated area in the world (Kumar et al., 2017). It is a short duration, quick growing and widely grown crop with high potential, there are no cereal crops with such an immense potentiality, so it is called as "queen of cereals" (Gangaiah, 2008). The production of maize depends on the correct agronomic practices and right application of inputs like fertilizer and improved seed varieties to sustain the environment and increase the production. The correct efficient -spacing and the suitable variety of the region are the best agronomic cultural practices which had important consideration during optimizing grain and above ground bio-mass yield (Enujeke, 2013). Maize seed contains 10% protein, 4% oil and 2-3% crude fiber. Maize kernel is an edible and nutritive part of the plant (Nwogboduhu, 2016). Different varieties of maize e.g., JM 218, JM 215, PRMH-306, JM-8, JM-13 are grown. The medium or late maturing varieties suffer due to water stress at maturity stage. The reasons of low productivity of rice in rain fed lowland ecosystem are many and varied. Lack of suitable varieties with stress tolerance at various stages of growth is one of the limiting factors (Ghimire et al*.,* 2016).

## 2. MATERIALS AND METHODS

The experiment was conducted at field of School of Agriculture science, Vikrant University, Gwalior, M.P. The experiment was laid out in Randomized Block Design (RBD) with three replications. Each replication was comprised of six treatments involving different varieties i.e. JM218, JM215, PRMH – 306, JM – 8 and JM – 13 of maize. The observations on different aspects such as growth parameters (viz., plant height (cm), days to silking stage, number of leaves plant$^{-1}$, dry matter accumulation plant$^{-1}$ and number of effective tillers metre$^{-1}$ row length) and yield parameters (viz., number of cobs per plant, girth of cob (cm), length of cob (cm), number of grains per cob, grain weight plant$^{-1}$, test weight (g), grain yield (q ha$^{-1}$), stover yield (q ha$^{-1}$) and harvest index) and economical parameters were calculated.

## 3. RESULTS AND DISCUSSION

### 3.1 Effect on Growth Parameters

#### 3.1.1 Plant population (m$^2$)

In the present investigation, results revealed that the initial and final population of plants was not influenced significantly due to different nutrient management applications.

#### 3.1.2 Plant height (cm)

In general, the plant height was minimum during early period of crop growth. However, the rate of increase in plant height was higher between 30 and 45 DAS. At all growth stages, the plant height was affected significantly under all treatments. Among the varieties PRMH – 306 recorded maximum plant height which was significantly more than that of JM218, JM215, JM - 8 and JM - 13. Control recorded significantly minimum plant height. These results of present study are in agreement with the findings of several other investigators (Reddy and Reddy 1997) and (Das et al. 2012).

#### 3.1.3 Dry matter accumulation (g plant$^{-1}$)

The dry matter accumulation by different varieties differed significantly as observed at all growth stages. Among the varieties PRMH–306 recorded maximum dry matter which was significantly more than that of JM218, JM215, JM-8 and JM-13. However, control recorded significantly minimum dry matter at different stages. It is evident from the data that dry matter accumulation (g plant$^{-1}$) gradually increased with the advancement in the growth being maximum at harvest under all the treatments. The results also confirm the findings of several other investigators by (Kudachikar and Janagoudar (1999).

### 3.1.4 No. of leaves/plant

The number of leaves/plant of different maize varieties differed significantly at all growth stages. Among the varieties PRMH – 306 recorded number of leaves/plant which was significantly more than that of JM218, JM215, JM-8 and JM-13 whereas control recorded significantly minimum number of leaves/plant at different stages. (Kumar et al. 2016, Sharma et al. 2021 and Layek et al. 2017).

### 3.1.5 Days to 50 % silking

It was recorded that there was non-significance difference had been observed due to all treatments and it was practically similar in all the treatments including control where no fertilizer was applied. These were supported by (Kumar et al. (2020).

### 3.1.6 Effect on yield parameters

Data on yield attributing character as influenced by different treatments are depicted. It was recorded that the yield attributing character varied significantly due to different characters of particular variety. Among all the treatments, the minimum yield attributing characters were recorded under control ($T_6$). The variety PRMH-306 registered more yield attributing character. Among the varieties PRMH – 306 registered maximum number of cobs plant $^{-1}$, number of grains cob$^{-1}$, cob girth, cob length no. of row cob$^{-1}$ and grain row$^{-1}$ whereas the minimum was recorded under control $T_6$ (Figs. 1&2). These results are concomitant with the findings of (Paulpandi et al.1998), Layek (2017) et al. and Kumar et al. (2019).

Yield character is the function of various growth and yield parameters like crop dry matter accumulation, number of grains/cob and test weight. It is clear from the results. These treatments caused significant variation in yield of maize. The minimum seed and stover yield was obtained under control ($T_6$), while it was increased when different varieties of maize were sown in different plots. Among the varieties PRMH – 306 produced significantly maximum grain and stover yield over rest of other varieties. These results confirm the findings of (Maddonni et al. (1996), Bandyopadhyay (1984) and Shao chang et al. (2003).

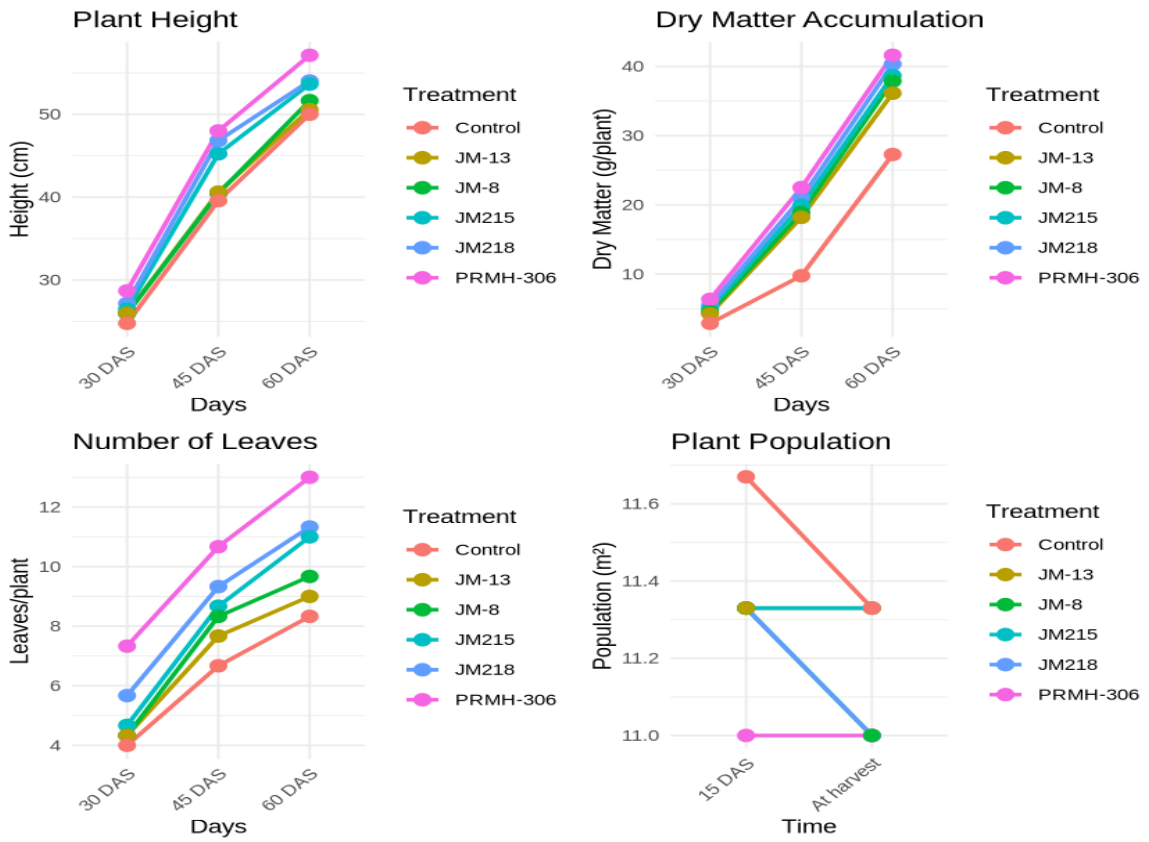


**Fig. 1. Effect of different varieties on growth parameters of maize**

**Table 1. Effect of different varieties on growth parameters of maize**

| T. No. | Treatments | Plant population ($m^2$) | | Plant height (cm) | | | Dry matter accumulation (g/plant) | | | No. of leaves/plant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15 DAS | At harvest | 30 DAS | 45 DAS | 60 DAS | 30 DAS | 45 DAS | 60 DAS | 30 DAS | 45 DAS | 60 DAS |
| $T_1$ | JM218 | 11.33 | 11.00 | 27.16 | 46.84 | 54.03 | 5.51 | 20.99 | 40.33 | 5.67 | 9.33 | 11.33 |
| $T_2$ | JM215 | 11.33 | 11.33 | 26.47 | 45.24 | 53.66 | 5.00 | 19.92 | 38.68 | 4.67 | 8.67 | 11.00 |
| $T_3$ | PRMH – 306 | 11.00 | 11.00 | 28.68 | 48.00 | 57.14 | 6.36 | 22.50 | 41.61 | 7.33 | 10.67 | 13.00 |
| $T_4$ | JM – 8 | 11.33 | 11.00 | 25.93 | 40.47 | 51.66 | 4.53 | 18.90 | 37.89 | 4.33 | 8.33 | 9.67 |
| $T_5$ | JM – 13 | 11.33 | 11.33 | 25.98 | 40.61 | 50.58 | 4.26 | 18.20 | 36.14 | 4.33 | 7.67 | 9.00 |
| $T_6$ | Control | 11.67 | 11.33 | 24.76 | 39.58 | 50.02 | 2.89 | 9.76 | 27.28 | 4.00 | 6.67 | 8.33 |
| SEm± | | 0.52 | 0.35 | 0.34 | 0.86 | 0.58 | 0.21 | 0.37 | 0.81 | 0.33 | 0.44 | 0.40 |
| CD (P=0.05) | | NS | NS | 1.08 | 2.74 | 1.86 | 0.66 | 1.20 | 2.57 | 1.05 | 1.41 | 1.29 |

**Table 2. Effect of different varieties on yield parameters of maize**

| T. No. | Treatments | Days to 50 % silking | Cob/ plant | Seeds/ cob | 100 grain weight | Length of cob (cm) | Girth of cob (cm) | No. of row/ cob | Grain/ row | Grain yield (kg/ha) | Stover yield (kg/ha) | HI (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | JM218 | | 1.67 | 363.33 | 22.00 | 35.66 | 12.56 | 12.33 | 26.67 | 5451 | 8093 | 40.25 |
| $T_2$ | JM215 | 55.33 | 1.00 | 337.00 | 21.38 | 34.05 | 12.04 | 11.67 | 25.33 | 5315 | 7526 | 41.39 |
| $T_3$ | PRMH-306 | 56.67 | 2.00 | 387.00 | 24.78 | 36.96 | 13.97 | 13.67 | 28.00 | 5781 | 8190 | 41.38 |
| $T_4$ | JM-8 | 52.67 | 1.33 | 331.33 | 20.49 | 34.43 | 11.65 | 11.33 | 24.67 | 5221 | 7302 | 41.69 |
| $T_5$ | JM-13 | 55.33 | 1.67 | 324.00 | 20.14 | 33.05 | 11.33 | 11.33 | 24.00 | 5164 | 7258 | 41.57 |
| $T_6$ | Control | 57.00 | 1.00 | 111.00 | 13.65 | 19.78 | 8.27 | 8.00 | 11.00 | 1985 | 6220 | 24.19 |
| SEm± | | | 0.20 | 7.84 | 0.36 | 0.66 | 0.31 | 0.36 | 0.50 | 45 | 546 | 0.72 |
| CD (P=0.05) | | | 0.64 | 25.03 | 1.15 | 2.10 | 0.99 | 1.15 | 1.60 | 145 | 1743 | 2.26 |

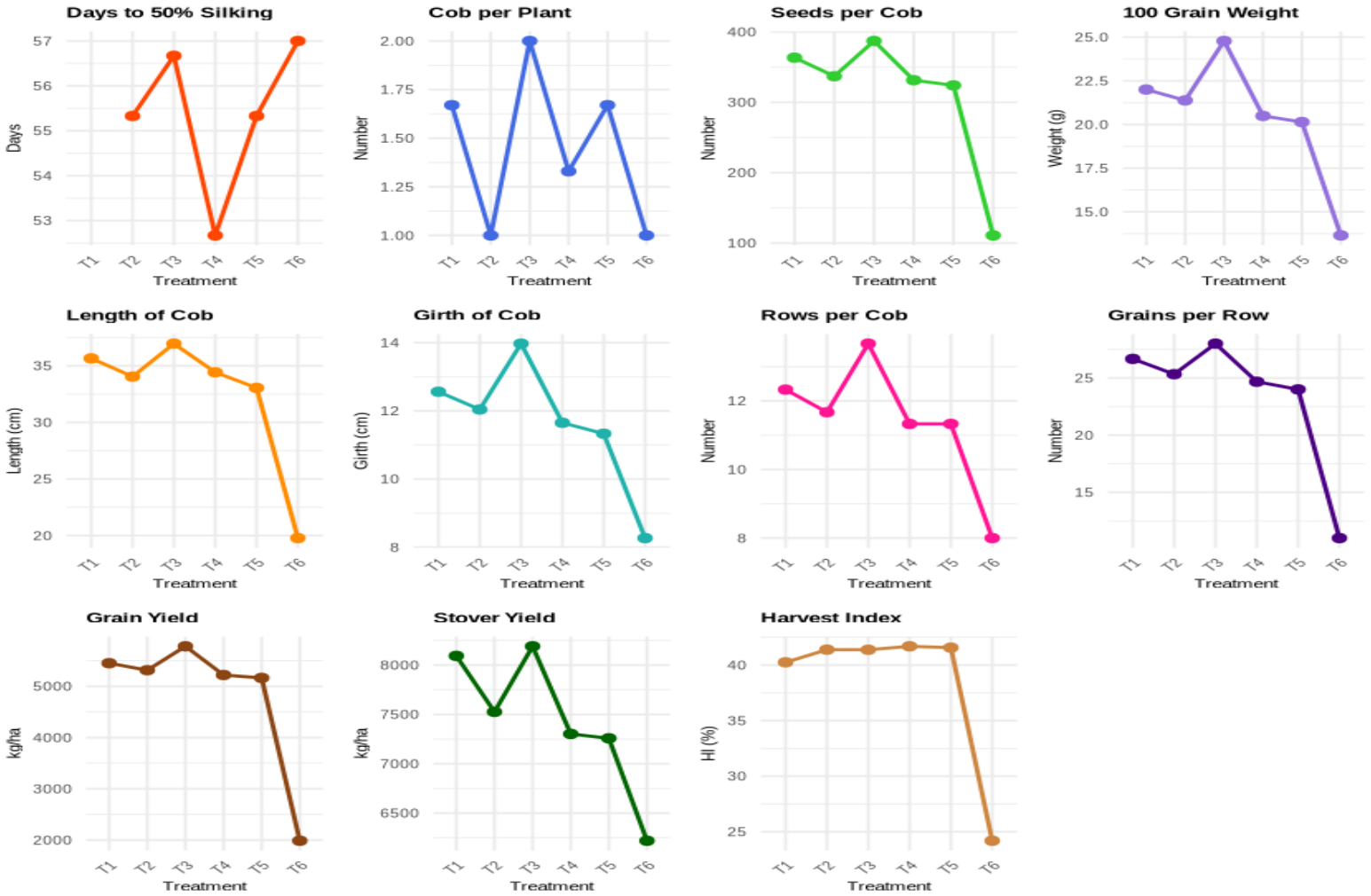


**Fig. 2. Effect of different varieties on yield parameters of maize**

The economic analysis of different treatments, as presented in Table 3 and Fig. 3, reveals that the cost of cultivation remained consistent across treatments at 35647 Rs/ha. Gross monetary returns (GMR), calculated based on the market value of economic produce, were highest for PRMH-306 (78044 Rs/ha) and lowest for the control (26798 Rs/ha). Net monetary returns (NMR), derived by subtracting the cost of cultivation from GMR, were negative (-8850 Rs/ha) for the control, while PRMH-306 recorded the highest NMR (42397 Rs/ha). The benefit-cost (B:C) ratio, indicating profitability per rupee of investment, was lowest (0.75) for the control and highest (2.19) for PRMH-306, followed by JM218 with a B:C ratio of 2.06. These results highlight the superior economic performance of PRMH-306 among the treatments. Similar findings of (Paulpandi et al.1998), Layek (2017) et al. and Kumar et al. (2019).

**Table 3. Effect of different cultivar on economic analysis of maize**

| T. No. | Treatments | Cost of Cultivation | Gross Monetary Returns | Net Monetary Returns | B:C |
|---|---|---|---|---|---|
| | | | ……..Rs/ha…….. | | |
| $T_1$ | JM218 | 35647 | 73589 | 37942 | 2.06 |
| $T_2$ | JM215 | 35647 | 71753 | 36106 | 2.01 |
| $T_3$ | PRMH – 306 | 35647 | 78044 | 42397 | 2.19 |
| $T_4$ | JM – 8 | 35647 | 70484 | 34837 | 1.98 |
| $T_5$ | JM – 13 | 35647 | 69714 | 34067 | 1.96 |
| $T_6$ | Control | 35647 | 26798 | -8850 | 0.75 |
| | SEm± | | 1452 | 937 | 0.05 |
| | CD (P=0.05) | | 4357 | 2813 | 0.15 |

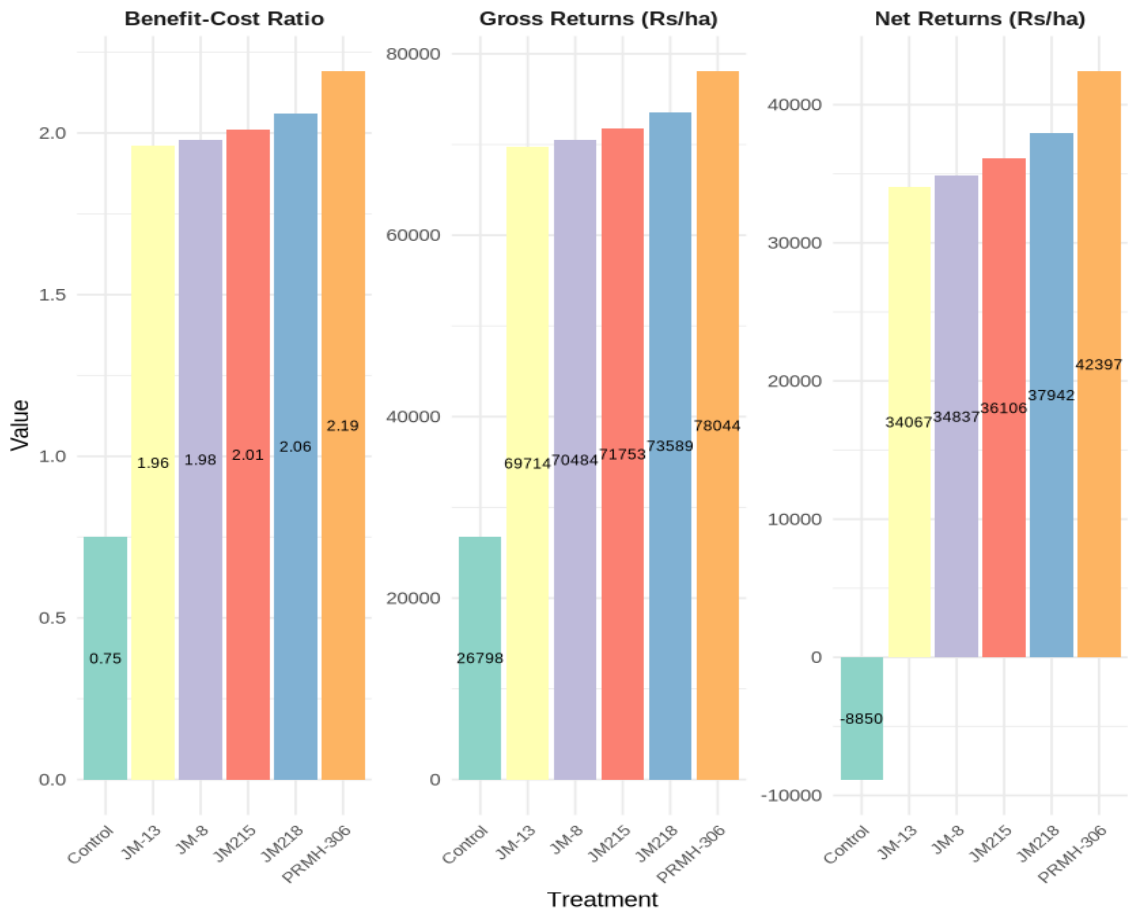


**Fig. 3. Effect of different cultivar on economic analysis of maize**

## 4. CONCLUSION

- Result concluded that the maize variety PRMH – 306 was found significantly superior variety for enhancing the growth and yield of maize as compared to rest of varieties.
- It was recorded that the maximum growth and yield parameters were observed under variety PRMH – 306, whereas the minimum were recorded under control.
- The variety PRMH – 306 may be more beneficial in terms of growth, productivity and profitability over rest of the treatments, which suggests that the varieties PRMH – 306 is more scientific management for under field condition as well as sandy loam soil for maize in region of Madhya Pradesh.
- The maximum net monetary returns (Rs 42397 /ha) and maximum benefit cost ratio (2.19) was recorded under cultivar PRMH-306.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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