# Correlation of immunogenicity and reactogenicity of BNT162b2 and CoronaVac SARS-CoV-2 Vaccines

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***Background*** COVID-19 infection is a global health issue. Although some therapies have been confirmed to have partial antiviral effects in clinical trials, there is still a lack of specific treatment. At present, some vaccines had been evaluated and included in the emergency use list, BNT162b2 and CoronaVac have been imported by Hong Kong government in early 2021. Therefore, the development of related vaccines and widespread vaccination is considered as an effective and promising measure to contain the pandemic. The aim of this study is to compare the effectiveness and safety of BNT162b2 and CoronaVac vaccines, and explore the relationship between the reactogenicity and immunogenicity of the two vaccines.

***Methods*** In this study, 189 participants received BNT162b2 or CoronaVac vaccine and 133 of them recorded adverse events (AE) daily for 4 weeks after vaccination. Blood was collected from the participants for antibody assay at three time points, including the baseline, day 21 (BNT162b2) or day 28 (CoronaVac), and day 56. Live virus microneutralization (vMN) assay was used to measure serum antibody titre.

***Results***

**Immunogenicity** (Table 1)

**Safety** Injection site pain (88.8%) and redness (77.5%) were the most commonly BNT162b2-related AE, and injection site pain (37.7%) and tiredness (26.4%) were more frequent in CoronaVac group. Women showed higher frequency of headache (45.7% vs. 29.4%) and joint pain (26.1 vs. 14.7%) than men in BTN162b2 group. Headache (26.5% vs. 0) and tiredness (38.2% vs. 5.3%) were more common in women than in men vaccinated with CoronaVac.

**Correlation between immunogenicity and reactogenicity** (Table 2)

***Conclusion*** Low correlations between antibody titre and symptoms in both genders were found. The degree of AEs would cause different negative impacts on public's acceptance of vaccination, but AEs may work as an indicator of immunogenicity of vaccine. Furthermore, a higher dose of vaccine for men may be considered so as to enhance antibody response to a level that is comparable with women.

**Table 1 Immunogenicity of CoronaVac and BNT162b2**

| | CoronaVac | | | BNT162b2 | | |
|---|---|---|---|---|---|---|
| | Female (n=61) | Male (n=34) | Total (n=95) | Female (n=53) | Male (n=41) | Total (n=94) |
| **Day 0** | | | | | | |
| **GMT value** | 5.0 (5.0-5.0) | 5.0 (5.0-5.0) | 5.0 (5.0-5.0) | 5.0 (5.0-5.0) | 5.0 (5.0-5.0) | 5.0 (5.0-5.0) |
| **Day 21*/28** | | | | | | |
| **GMT value** | 5.7 (5.2-6.2) | 5.8 (5.0 -6.6) | 5.71 (5.31-6.14) | 11.5 (8.4-15.9) * | 10.9 (7.6-15.6) * | 11.3 (8.9-14.3) * |
| **Seroprotection** | 0 (0) | 0 (0) | 0 (0) | 10 (18.9%) | 4 (9.8%) | 14 (14.9%) |
| **Day 56** | | | | | | |
| **GMT value** | 14.0 (11.6-17.0) | 11.4 (8.7–15.0) | 13.1 (11.2-15.3) | 147.9 (118.9-184.1) | 109.3 (81.6-146.3) | 129.9 (108.6-155.2) |
| **Seroprotection** | 7 (14.9%)[a] | 2 (7.7%)[b] | 9 (12.3%) | 53 (100%)[c] | 36 (90%)[d] | 89 (96.7%) |

GMT: geometric mean titre, data presentation: GMT values (95% CI); * Day 21: BNT162b2, Day 28: CoronaVac; Seroprotection: vMN titre≥40; a: 47 subjects took blood on Day 56; b. 26 subjects took blood on Day 56; c: 53 subjects took blood on Day 56; d: 40 subjects took blood on Day 56.

**Table 2 Correlation between antibody response and adverse events of COVID-19 vaccines**

| | CoronaVac (n=53) | | BNT162b2 (n=80) | |
|---|---|---|---|---|
| | Day28 MN titre | Day56 MN titre | Day21 MN titre | Day56 MN titre |
| | rho (p value) | rho (p value) | rho (p value) | rho (p value) |
| **Systemic reactions** | -0.16 (0.257) | 0.10 (0.467) | 0.20 (0.083) | 0.008 (0.947) |
| Fever | - | - | 0.16 (0.147) | 0.22 (0.048) |
| Chills | -0.062 (0.668) | 0.047 (0.737) | - | 0.095 (0.404) |
| Headache | 0.060 (0.678) | 0.038 (0.787) | 0.000 (0.998) | -0.086 (0.451) |
| Tiredness | -0.076 (0.600) | 0.051 (0.719) | 0.14 (0.211) | -0.025 (0.826) |
| Nausea | -0.089 (0.540) | 0.15 (0.271) | -0.058 (0.607) | -0.077 (0.499) |
| Vomit | - | 0.21 (0.134) | - | 0.033 (0.771) |
| Diarrhea | 0.18 (0.217) | 0.28 (0.039) | 0.12 (0.308) | 0.13 (0.256) |
| Muscle pain | -0.059 (0.686) | 0.041 (0.772) | 0.17 (0.123) | -0.12 (0.282) |
| Joint pain | -0.089 (0.540) | -0.12 (0.396) | 0.12 (0.291) | -0.18 (0.112) |
| Skin rash | -0.062 (0.668) | -0.062 (0.661) | 0.19 (0.101) | 0.11 (0.324) |
| **Local reactions** | 0.14 (0.328) | 0.12 (0.400) | 0.11 (0.340) | -0.066 (0.565) |
| Pain | 0.14 (0.338) | 0.11 (0.417) | 0.051 (0.651) | -0.094 (0.411) |
| Redness | - | -0.062 (0.661) | 0.21 (0.062) | 0.036 (0.751) |
| Swelling | 0.31 (0.028) | 0.10 (0.458) | 0.13 (0.270) | 0.077 (0.498) |
| Ecchymosis | - | - | 0.17 (0.131) | 0.12 (0.278) |
| Itching | 0.31 (0.028) | 0.15 (0.287) | 0.19 (0.099) | -0.044 (0.703) |

rho: Spearman's correlation coefficient; 0.5>rho>0.3, low positive correlation; $p<0.05$: the correlation coefficient is statistically significant