Notes on the Design of Bioequivalence Study:
Daclatasvir

Notes on the design of bioequivalence studies with products invited for submission to the WHO Prequalification Team: medicines (PQTm) are issued to aid manufacturers with the development of their product dossier. Deviations from the approach suggested below may be considered acceptable if justified by sound scientific evidence.


Below additional specific guidance is provided on the invited immediate release products containing daclatasvir.

**Pharmacokinetics of daclatasvir**

Daclatasvir administered as a tablet is readily absorbed following multiple oral doses with peak plasma concentrations occurring between 1 and 2 hours. Daclatasvir $C_{\text{max}}$, AUC, and $C_{\text{min}}$ increased in a near dose-proportional manner.

In healthy subjects, administration of daclatasvir 60 mg tablet after a high-fat meal decreased daclatasvir $C_{\text{max}}$ and AUC by 28% and 23%, respectively, compared with administration under fasting conditions. Administration of daclatasvir 60 mg tablet after a light meal resulted in no reduction in daclatasvir exposure.

Following multiple-dose administration of daclatasvir in hepatitis C-infected patients, the terminal elimination half-life of daclatasvir ranged from 12 to 15 hours.

**Guidance for the design of bioequivalence studies**

Taking into account the pharmacokinetic properties of daclatasvir, the following guidance with regard to the study design should be taken into account:

**Dose**: As daclatasvir is marketed as 30 mg, 60 mg and 90 mg tablets, but only the 30 mg and 60 mg strengths are included presently in the WHO Expression of Interest, a 60 mg dose using the 60 mg tablet strength should be used in the bioequivalence study, since the pharmacokinetics are reported to increase with dose in a nearly dose-proportional manner.

**Fasting/fed**: The bioequivalence study should be conducted in the fasted state as daclatasvir may be taken with or without meals.
**Subjects:** Healthy adult subjects should be used. It is not necessary to include patients in the bioequivalence study.

**Sample size:** Daclatasvir $C_{\text{max}}$ in the fasted state has a low to moderate intra-subject variability (17–20%). These data may facilitate the calculation of a sufficient sample size for a cross-over bioequivalence study.

**Washout:** Taking into account the elimination half-life of daclatasvir in healthy volunteers (approximately fifteen hours), a washout period of seven days is considered sufficient to prevent carry over.

**Blood sampling:** The blood sampling for daclatasvir should be intensive in the first three hours after administration to properly characterize the $C_{\text{max}}$ of daclatasvir. It is not necessary to take blood samples beyond 72 hours.

**Analytical considerations:** Information currently available to PQTm indicates that it is possible to measure daclatasvir in human plasma using LC-MS/MS analytical methodology. The bioanalytical method should be sufficiently sensitive to detect concentrations that are 5% of the $C_{\text{max}}$ in most profiles of each formulation (test or comparator).

**Parent or metabolite data for assessment of bioequivalence:** The parent drug is considered to best reflect the biopharmaceutical quality of the product. The data for the parent compound should be used to assess bioequivalence.

**Statistical considerations:** The data for daclatasvir should meet the following bioequivalence standards in a single-dose, crossover design study:

- The 90% confidence interval of the relative mean AUC$_{0-t}$ of the test to reference product should be within 80–125%
- The 90% confidence interval of the relative mean $C_{\text{max}}$ of the test to reference product should be within 80–125%.

Information currently available to PQTm indicates that the comparator product is not a highly variable drug product for AUC and $C_{\text{max}}$ in fasted state.