$$\frac{(2\pi)^{d-r}}{\Gamma^{X}_{d/r}}\frac{\Gamma^{r}_{1+a/2}}{\Gamma_{1+ra/2}}\int_{dx_i}^{0\,\overset{r}{\rceil}\,1} {}^{x}\Phi^{\varkappa}\prod_{i} x_i^{\alpha}\,\overbrace{1-x_i}^{\beta}\prod_{i<j}\overline{x_j-x_i}^{\,a} = \frac{\Gamma^{X}_{\varkappa+\alpha+d/r}\Gamma^{X}_{\beta+d/r}}{\Gamma^{X}_{\varkappa+\alpha+\beta+2d/r}}$$

$$f^{a/2}_{\varkappa} = \prod_{i<j}\frac{\Gamma_{\varkappa_i-\varkappa_j+(j-i+1)\,a/2}}{\Gamma_{\varkappa_i-\varkappa_j+(j-i)\,a/2}}$$

$$r!\,f^{a/2}_{0} = r!\prod_{i<j}\frac{\Gamma_{(j-i+1)\,a/2}}{\Gamma_{(j-i)\,a/2}} = r!\prod_{i}\frac{\Gamma_{(r+1-i)\,a/2}}{\Gamma_{a/2}} = \frac{\prod_{k} k\Gamma_{ka/2}}{\Gamma^{r}_{a/2}} = \frac{\prod_{k}\Gamma_{ka/2}ka/2}{\Gamma^{r}_{a/2}(a/2)^{r}} = \frac{\prod_{k}\Gamma_{1+ka/2}}{\Gamma^{r}_{1+a/2}}$$

$$= \frac{\Gamma_{1+ra/2}}{\Gamma^{r}_{1+a/2}}\prod_{i}\Gamma_{1+(r-i)\,a/2} = \frac{\Gamma_{1+ra/2}}{\Gamma^{r}_{1+a/2}}\frac{\Gamma^{X}_{d/r}}{\sqrt{2\pi}^{\,d-r}}$$

$${}^{e}s^{a/2}_{\varkappa} \overset{\text{KAD}}{=} f^{a/2}_{\varkappa}\,/\,f^{a/2}_{0}$$

$$\frac{1}{\sqrt{2\pi}^{\,d-r}}\frac{\Gamma^{X}_{\varkappa+\alpha+d/r}\Gamma^{X}_{\beta+d/r}}{\Gamma^{X}_{\varkappa+\alpha+\beta+2d/r}} = \prod_{i}\frac{\Gamma_{\varkappa_i+\alpha+d/r-(i-1)\,a/2}\Gamma_{\beta+d/r-(i-1)\,a/2}}{\Gamma_{\varkappa_i+\alpha+\beta+2d/r-(i-1)\,a/2}}$$

$$= \prod_{i}\frac{\Gamma_{\varkappa_i+\alpha+1+(r-i)\,a/2}\Gamma_{\beta+1+(r-i)\,a/2}}{\Gamma_{\varkappa_i+\alpha+\beta+2+(2r-i-1)\,a/2}} \overset{\text{KAD}}{=} \frac{1}{r!\,f^{a/2}_{\varkappa}}\int_{dx}^{0\,\overset{r}{\rceil}\,1} {}^{x}s^{a/2}_{\varkappa}\prod_{i} x_i^{\alpha}\,\overbrace{1-x_i}^{\beta}\prod_{i<j}\overline{x_i-x_j}^{\,a}$$

$$= \frac{1}{r!\,f^{a/2}_{0}}\int_{dx}^{0\,\overset{r}{\rceil}\,1} {}^{x}\Phi^{\varkappa}\prod_{i} x_i^{\alpha}\,\overbrace{1-x_i}^{\beta}\prod_{i<j}\overline{x_i-x_j}^{\,a} = \frac{\Gamma^{r}_{1+a/2}}{\Gamma_{1+ra/2}}\frac{\sqrt{2\pi}^{\,d-r}}{\Gamma^{X}_{d/r}}\int_{dx}^{0\,\overset{r}{\rceil}\,1} {}^{x}\Phi^{\varkappa}\prod_{i} x_i^{\alpha}\,\overbrace{1-x_i}^{\beta}\prod_{i<j}\overline{x_i-x_j}^{\,a}$$

$$f^{a/2}_{0} = \prod_{i}\frac{\Gamma_{ra/2-(i-1)\,a/2}}{\Gamma_{a/2}} = \frac{\Gamma^{X}_{ra/2}}{\Gamma^{r}_{a/2}\sqrt{2\pi}^{\,d-r}}$$

$$P_{\varkappa}(e) = \prod_{i:j\,\in\,\varkappa}\frac{r+1-i+\dfrac{2}{a}(j-1)}{\varkappa^{\sharp}_{j}+1-i+\dfrac{2}{a}\left(\varkappa_i-j\right)} = \prod_{i:j\,\in\,\varkappa}\frac{\dfrac{a}{2}(r+1-i)+j-1}{\dfrac{a}{2}\left(\varkappa^{\sharp}_{j}+1-i\right)+\varkappa_i-j}$$