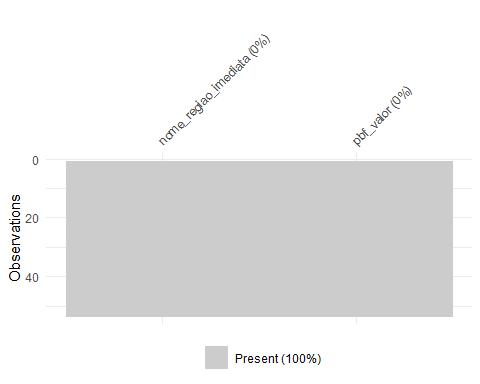
multivariada05

Panosso AR & Oliveira JA

2023-07-14

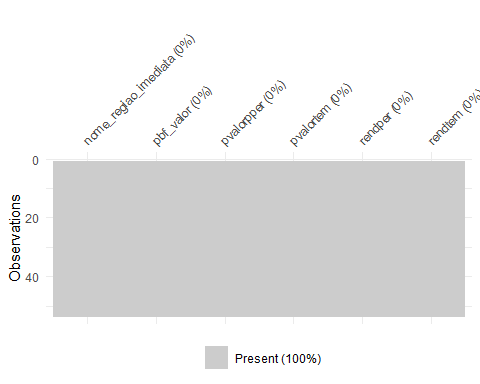
### Base de dados - “im”

# Carregando a base de dados  
im <- read\_rds("data/im.rds") %>%   
 select(nome,id\_municipio:valor\_pago\_pbf)  
  
im <- left\_join(im,  
 df\_nomes %>%   
 select(nome, nome\_regiao\_imediata),  
 by = "nome") %>%   
 relocate(nome, nome\_regiao\_imediata)  
  
  
tab\_im <- im %>% filter(ano >= 2010) %>%   
 group\_by(nome\_regiao\_imediata, nome, ano) %>%   
 summarise(  
 familias\_beneficiarias\_pbf = mean(familias\_beneficiarias\_pbf,na.rm=TRUE),  
 pessoas\_beneficiarias\_pbf = mean(pessoas\_beneficiarias\_pbf,na.rm=TRUE),  
 valor\_pago\_pbf = mean(valor\_pago\_pbf,na.rm=TRUE)  
 ) %>%   
 group\_by(ano, nome\_regiao\_imediata) %>% filter(ano >=2010, ano < 2020) %>%   
 summarise(  
 nfamilias = sum(familias\_beneficiarias\_pbf, na.rm=TRUE),  
 npessoa = sum(pessoas\_beneficiarias\_pbf, na.rm=TRUE),  
 valorpago = sum(valor\_pago\_pbf, na.rm=TRUE),  
 )  
  
base\_multivariada <- tab\_im %>%   
 filter(ano>= 2015, ano < 2020) %>%   
 group\_by(nome\_regiao\_imediata) %>%   
 summarise(  
 pbf\_valor = sum(valorpago, na.rm=TRUE)  
 )  
visdat::vis\_miss(base\_multivariada)



### Base de dados “lavouras”

lavoura\_permanente <- read\_rds("data/permanente.rds")   
lavoura\_temporaria <- read\_rds("data/temporaria.rds")  
lavouras <- rbind(lavoura\_permanente %>%   
 mutate(tipo = "permanente"),  
 lavoura\_temporaria %>%   
 mutate(tipo = "temporaria")  
)  
lavouras$na <- apply(  
 lavouras[5:12],  
 1,   
 function(x) sum(is.na(x))  
)  
  
lavouras <- lavouras %>%   
 filter(na != 8, ano >= 2010,  
 produto != "Café (em grão) Arábica",  
 produto != "Café (em grão) Canephora") %>%   
 select(-na)  
  
lavouras <- lavouras %>%   
 group\_by(tipo, ano, nome) %>%   
 summarise(  
 n\_produtos = n(),  
 area\_plantada = sum(area\_plantada,na.rm=TRUE),  
 rendimento\_medio = mean(rendimento\_medio,na.rm=TRUE),  
 prop\_area\_colhida = mean(prop\_area\_colhida,na.rm=TRUE) ,  
 prop\_valor\_producao = mean(prop\_valor\_producao,na.rm=TRUE)  
 ) %>%   
 pivot\_wider(names\_from = tipo,  
 values\_from = n\_produtos:prop\_valor\_producao)  
  
  
lavouras <- left\_join(lavouras, df\_nomes %>%   
 select(nome, nome\_regiao\_imediata),  
 by = "nome") %>%   
 relocate(ano, nome, nome\_regiao\_imediata)  
  
lavouras\_resu <- lavouras %>%   
 group\_by(nome\_regiao\_imediata) %>%   
 summarize(  
 npper = mean(n\_produtos\_permanente,na.rm=TRUE),   
 nptem = mean(n\_produtos\_temporaria,na.rm=TRUE),   
 areapper = mean(area\_plantada\_permanente,na.rm=TRUE),   
 areapltem = mean(area\_plantada\_temporaria,na.rm=TRUE),   
 rendper = mean(rendimento\_medio\_permanente,na.rm=TRUE),   
 rendtem = mean(rendimento\_medio\_temporaria,na.rm=TRUE),   
 pacolhidaper = mean(prop\_area\_colhida\_permanente,na.rm=TRUE),   
 pacolhidatem = mean(prop\_area\_colhida\_temporaria,na.rm=TRUE),   
 pvalorpper = mean(prop\_valor\_producao\_permanente,na.rm=TRUE),   
 pvalortem = mean(prop\_valor\_producao\_temporaria,na.rm=TRUE)   
 )  
  
base\_multivariada <- left\_join(base\_multivariada,  
 lavouras\_resu %>%   
 select(nome\_regiao\_imediata,  
 pvalorpper,  
 pvalortem,  
 rendper,  
 rendtem),  
 by = "nome\_regiao\_imediata")  
  
visdat::vis\_miss(base\_multivariada)

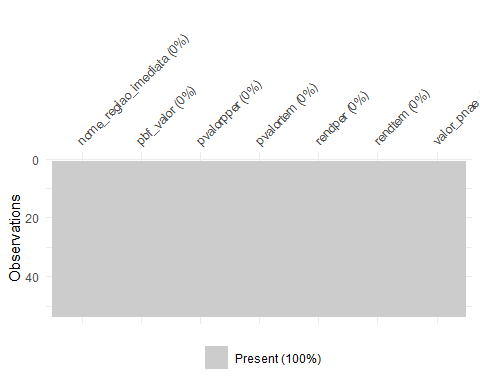


### Base de dados - “pnae”

pnae\_alunos <- read\_rds("data/pnae\_alunos\_atendidos.rds")  
lista\_etapas <- pnae\_alunos$etapa\_ensino %>% unique()  
pnae\_recurso <- read\_rds("data/pnae\_recurso.rds")   
pnae\_recurso <- pnae\_recurso %>%   
 mutate(  
 modalidade\_ensino = ifelse(modalidade\_ensino == "EJA",  
 "EDUCAÇÃO DE JOVENS E ADULTOS (EJA)",  
 modalidade\_ensino)  
 )

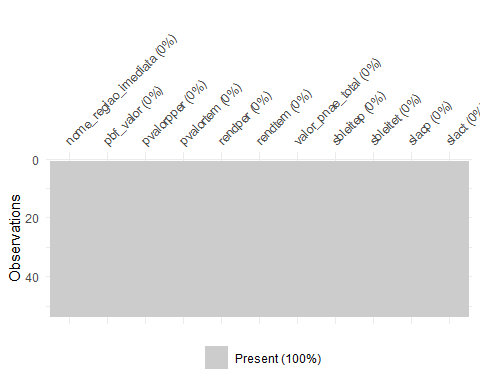
pnae\_recurso <- pnae\_recurso %>%   
 group\_by(nome, ano, esfera\_governo, modalidade\_ensino) %>%   
 summarise(vl\_total\_escolas = mean(vl\_total\_escolas)) %>%   
 rename(etapa\_ensino = modalidade\_ensino) %>%   
 filter(etapa\_ensino %in% lista\_etapas)  
  
pnae <- left\_join(pnae\_alunos %>% filter(esfera\_governo == "MUNICIPAL") %>%  
 select(ano:qt\_alunos\_pnae,nome),  
 pnae\_recurso,  
 by =c("nome","ano","esfera\_governo","etapa\_ensino"))  
  
pnae <- left\_join(pnae, df\_nomes %>%   
 select(nome, nome\_regiao\_imediata),  
 by = "nome")

pnae\_resumo <- pnae %>%   
 # filter(ano >= 2010, ano <= 2020) %>%   
 # drop\_na() %>%   
 group\_by(ano, nome\_regiao\_imediata, etapa\_ensino) %>%   
 summarise(  
 qt\_alunos\_pnae = sum(qt\_alunos\_pnae,na.rm=TRUE),  
 vl\_total\_escolas = sum(vl\_total\_escolas,na.rm=TRUE)  
 ) %>%   
 pivot\_wider(  
 names\_from = etapa\_ensino,  
 values\_from = c(qt\_alunos\_pnae,vl\_total\_escolas)) %>%   
 group\_by(nome\_regiao\_imediata) %>%   
 mutate(  
 across(qt\_alunos\_pnae\_CRECHE:`vl\_total\_escolas\_ATENDIMENTO EDUCACIONAL ESPECIALIZADO (AEE)`, function(x) mean(x,na.rm=TRUE))) %>%   
 janitor::clean\_names() %>%   
 filter(ano == 2007) %>%   
 select(-ano)  
  
pnae\_resumo <- pnae\_resumo %>%   
 select(-qt\_alunos\_pnae\_ensino\_medio,  
 -qt\_alunos\_pnae\_indigena,  
 -qt\_alunos\_pnae\_quilombola,  
 -vl\_total\_escolas\_ensino\_medio,  
 -vl\_total\_escolas\_indigena,  
 -vl\_total\_escolas\_quilombola  
 )  
nomes\_antigos <- names(pnae\_resumo)  
nomes\_novos <- c(  
 "nome", "qt\_creche", "qt\_eja", "qt\_fundamental",   
 "qt\_pre\_escola", "qt\_aee", "vl\_creche", "vl\_eja",   
 "vl\_fundamental", "vl\_pre\_escola", "vl\_aee")  
pnae\_resumo <- pnae\_resumo %>%   
 rename\_at(vars(nomes\_antigos),~nomes\_novos)  
  
pnae\_resumo$valor\_pnae\_total <- pnae\_resumo %>%   
 rename(nome\_regiao\_imediata = nome) %>%   
 ungroup() %>%   
 select(starts\_with("vl\_")) %>% apply(.,1,sum)  
  
base\_multivariada<-left\_join(base\_multivariada,  
 pnae\_resumo %>%   
 rename(nome\_regiao\_imediata = nome) %>%   
 ungroup() %>%   
 select(nome\_regiao\_imediata,valor\_pnae\_total),  
 by = "nome\_regiao\_imediata")  
visdat::vis\_miss(base\_multivariada)

 ### Base de dados - “sisvan”

sisvan\_estab <- read\_rds("data/sisvan\_estab.rds")  
sisvan <- sisvan\_estab %>%   
 group\_by(municipio, ano) %>%   
 summarise(  
 servico\_nutricao\_proprio =   
 sum(indicador\_servico\_nutricao\_proprio),  
 servico\_nutricao\_terceirizado =   
 sum(indicador\_servico\_nutricao\_terceirizado),  
 servico\_lactario\_proprio =   
 sum(indicador\_servico\_lactario\_proprio), servico\_lactario\_terceirizado =   
 sum(indicador\_servico\_lactario\_terceirizado), servico\_banco\_leite\_proprio =   
 sum(indicador\_servico\_banco\_leite\_proprio), servico\_banco\_leite\_terceirizado=  
 sum(indicador\_servico\_banco\_leite\_terceirizado),  
 # total = trunc(n()/12)  
 ) %>% mutate(nome = municipio)  
  
sisvan\_estab <- left\_join(sisvan\_estab %>%   
 mutate(nome = municipio),   
 df\_nomes %>%  
 select(nome, nome\_regiao\_imediata),  
 by = "nome")

sisvan <- left\_join(sisvan,  
 df\_nomes %>%   
 select(nome, nome\_regiao\_imediata),  
 by = "nome")  
  
  
sisvan\_resumo <- sisvan %>%   
 group\_by(nome\_regiao\_imediata, nome) %>%   
 summarise(  
 snutrip = mean(servico\_nutricao\_proprio,na.rm=TRUE),  
 snutrit = mean(servico\_nutricao\_terceirizado,na.rm=TRUE),   
 slacp = mean(servico\_lactario\_proprio,na.rm=TRUE),  
 slact = mean(servico\_lactario\_terceirizado,na.rm=TRUE),   
 sbleitep = mean(servico\_banco\_leite\_proprio,na.rm=TRUE),  
 sbleitet = mean(servico\_banco\_leite\_terceirizado,na.rm=TRUE),  
 ) %>%   
 group\_by(nome\_regiao\_imediata) %>%  
 summarise(  
 snutrip = sum(snutrip,na.rm=TRUE),  
 snutrit = sum(snutrit,na.rm=TRUE),   
 slacp = sum(slacp,na.rm=TRUE),  
 slact = sum(slact,na.rm=TRUE),   
 sbleitep = sum(sbleitep,na.rm=TRUE),  
 sbleitet = sum(sbleitet,na.rm=TRUE),  
 )   
  
base\_multivariada <- left\_join(base\_multivariada,  
 sisvan\_resumo %>%   
 select(nome\_regiao\_imediata,  
 sbleitep,sbleitet,slacp,slact),  
 by = "nome\_regiao\_imediata")  
visdat::vis\_miss(base\_multivariada)

 ### Base de Dados “Estado Nutricional”

estado\_nutricional <- read\_rds("data/df\_final.rds") %>%   
 group\_by(ano,fase\_da\_vida,idade,indice,municipio) %>%   
 mutate(valor\_p = valor/sum(valor)\*100) %>%   
 ungroup()

estado\_nutricional <- left\_join(estado\_nutricional,   
 df\_nomes %>% select(nome, id\_municipio\_6,nome\_regiao\_imediata) %>%   
 rename(id\_municipio = id\_municipio\_6),  
 by = c("id\_municipio")) %>%   
 select(-regiao,-uf,-codigo\_uf,-id\_municipio,-municipio,-indice\_cri,  
 -indice\_ado,-valor) %>% relocate(ano,nome,nome\_regiao\_imediata) %>%   
 pivot\_wider(names\_from = c(fase\_da\_vida, idade, indice, classe),  
 values\_from = c(valor\_p)) %>%   
 janitor::clean\_names()

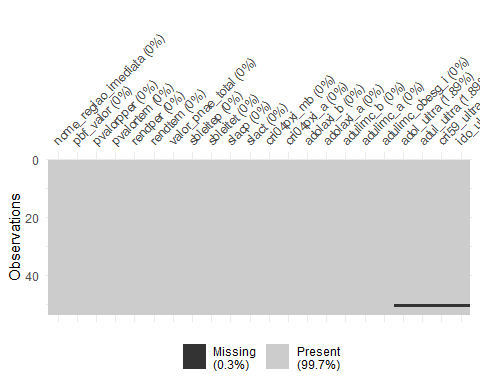
estado\_nutri\_resumo <- estado\_nutricional %>%   
 group\_by(nome) %>%   
 mutate(across(crianca\_0\_4\_peso\_x\_idade\_muito\_baixo:idoso\_imc\_sobrepeso,mean)) %>%   
 filter(ano == 2017) %>%   
 select(-ano)

# estado\_nutri\_resumo %>% names  
nomes\_antigos <- names(estado\_nutri\_resumo)  
estado\_nutri\_resumo <- estado\_nutri\_resumo %>%   
 rename\_at(vars(nomes\_antigos), ~novos\_nomes)

consumo <- read\_rds("data/consumo/consumo.rds")  
consumo <- left\_join(consumo, df\_nomes %>% select(nome, id\_municipio\_6, nome\_regiao\_imediata) %>%   
 rename(codigo\_ibge = id\_municipio\_6) %>%  
 mutate(codigo\_ibge = as.numeric(codigo\_ibge)),  
 by = c("codigo\_ibge"))  
  
consumo <- consumo %>% select(-faixa\_etaria, -codigo\_ibge, -municipio,  
 -uf, -total, -monitorados) %>%   
 filter(fase\_da\_vida != "entre-6-meses-23-meses")  
  
consumo <- consumo %>%   
 pivot\_wider(names\_from = c(fase\_da\_vida,tipo\_relatorio),  
 values\_from = percent) %>%   
 janitor::clean\_names()  
consumo$nome\_regiao\_imediata %>% unique()  
#> [1] "Adamantina - Lucélia"   
#> [2] "São João da Boa Vista"   
#> [3] "Avaré"   
#> [4] "Presidente Prudente"   
#> [5] "Ribeirão Preto"   
#> [6] "Birigui - Penápolis"   
#> [7] "Marília"   
#> [8] "São Paulo"   
#> [9] "Bragança Paulista"   
#> [10] "Jaú"   
#> [11] "Bauru"   
#> [12] "Barretos"   
#> [13] "Assis"   
#> [14] "São José dos Campos"   
#> [15] "São José do Rio Pardo - Mococa"   
#> [16] "Campinas"   
#> [17] "Taubaté - Pindamonhangaba"   
#> [18] "Itapeva"   
#> [19] "Sorocaba"   
#> [20] "São José do Rio Preto"   
#> [21] "Limeira"   
#> [22] "Rio Claro"   
#> [23] "Dracena"   
#> [24] "Mogi Guaçu"   
#> [25] "Fernandópolis"   
#> [26] "Registro"   
#> [27] "Caraguatatuba - Ubatuba - São Sebastião"   
#> [28] "Catanduva"   
#> [29] "Itapetininga"   
#> [30] "Jundiaí"   
#> [31] "Cruzeiro"   
#> [32] "Votuporanga"   
#> [33] "São Joaquim da Barra ¿ Orlândia"   
#> [34] "Tupã"   
#> [35] "Piracicaba"   
#> [36] "São Carlos"   
#> [37] "Ourinhos"   
#> [38] "Araraquara"   
#> [39] "Botucatu"   
#> [40] "Santos"   
#> [41] "Jales"   
#> [42] "Araçatuba"   
#> [43] "Andradina"   
#> [44] "Santa Fé do Sul"   
#> [45] "Piraju"   
#> [46] "Tatuí"   
#> [47] "Amparo"   
#> [48] "Ituverava"   
#> [49] "Lins"   
#> [50] "Presidente Epitácio-Presidente Venceslau"  
#> [51] "Franca"   
#> [52] "Araras"   
#> [53] "Guaratinguetá"

consumo\_estado\_nutricional <- left\_join(consumo, estado\_nutricional,  
 by=c("ano","nome","nome\_regiao\_imediata"))  
  
consumo\_resumo <- consumo %>%   
 group\_by(nome\_regiao\_imediata, nome) %>%   
 summarise(  
 adol\_embut = mean(adolecentes\_cons\_embut,na.rm=TRUE),   
 adol\_ultra = mean(adolecentes\_cons\_ultra,na.rm=TRUE),   
 adul\_embut = mean(adultos\_cons\_embut,na.rm=TRUE),   
 adul\_ultra = mean(adultos\_cons\_ultra,na.rm=TRUE),   
 cri24\_embut = mean(criancas\_2\_4\_cons\_embut,na.rm=TRUE),  
 cri24\_ultra = mean(criancas\_2\_4\_cons\_ultra,na.rm=TRUE),   
 cri59\_embut = mean(criancas\_5\_9\_cons\_embut,na.rm=TRUE),  
 cri59\_ultra = mean(criancas\_5\_9\_cons\_ultra,na.rm=TRUE),  
 ido\_embut = mean(idosos\_cons\_embut,na.rm=TRUE),   
 ido\_ultra = mean(idosos\_cons\_ultra,na.rm=TRUE)   
 )  
  
consumo\_estado\_nutricional\_resumo <- left\_join(  
 estado\_nutri\_resumo %>%   
 rename(nome\_regiao\_imediata = nome\_regiao\_intermediaria) %>%   
 ungroup(), consumo\_resumo %>% ungroup(),  
 by = c("nome","nome\_regiao\_imediata"))

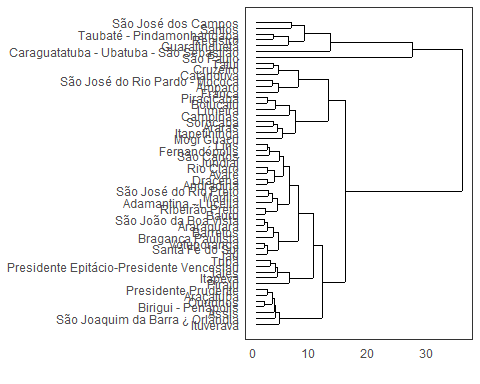
consumo\_estado\_nutricional\_resumo <- consumo\_estado\_nutricional\_resumo %>%  
 group\_by(nome\_regiao\_imediata) %>%   
 mutate(across(where(is.numeric), function(x) {  
 mean(x,na.rm=TRUE)  
 })) %>% select(-nome) %>%   
 distinct() %>% ungroup()  
  
base\_multivariada\_final<-left\_join(base\_multivariada,  
 consumo\_estado\_nutricional\_resumo %>%   
 select(nome\_regiao\_imediata, cri04pxi\_mb,cri04pxi\_a,adolaxi\_b,adolaxi\_a,adulimc\_b,adulimc\_a,adulimc\_obesg\_i,adol\_ultra,adul\_ultra,cri59\_ultra,ido\_ultra),  
 by = "nome\_regiao\_imediata")  
  
visdat::vis\_miss(base\_multivariada\_final)



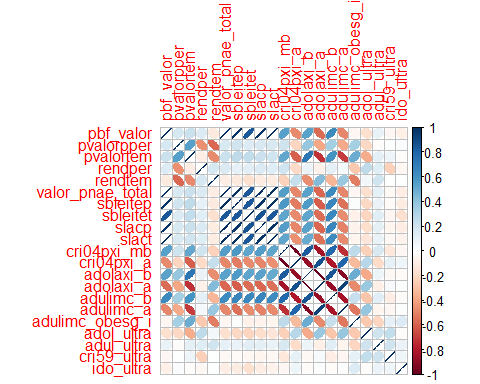
glimpse(base\_multivariada\_final)  
#> Rows: 53  
#> Columns: 22  
#> $ nome\_regiao\_imediata <chr> "Adamantina - Lucélia", "Amparo", "Andradina", "A~  
#> $ pbf\_valor <dbl> 3655522, 1848876, 4697117, 11989151, 6310988, 610~  
#> $ pvalorpper <dbl> 19.01167, 20.04964, 34.38235, 31.96290, 26.18040,~  
#> $ pvalortem <dbl> 17.85245, 25.74657, 22.38499, 20.42814, 18.84430,~  
#> $ rendper <dbl> 13616.352, 19480.213, 13004.928, 16689.464, 19592~  
#> $ rendtem <dbl> 23779.269, 29686.811, 23920.631, 24838.026, 27655~  
#> $ valor\_pnae\_total <dbl> 3668001, 3512074, 5931450, 17767865, 8895151, 878~  
#> $ sbleitep <dbl> 32.29411765, 0.00000000, 0.00000000, 31.76470588,~  
#> $ sbleitet <dbl> 0.0000000, 0.0000000, 0.0000000, 7.8823529, 0.000~  
#> $ slacp <dbl> 12.52941, 14.82353, 52.35294, 118.47059, 37.70588~  
#> $ slact <dbl> 0.000000, 3.352941, 7.352941, 14.235294, 2.882353~  
#> $ cri04pxi\_mb <dbl> 0.6392025, 0.7212714, 0.9177096, 1.2951341, 3.694~  
#> $ cri04pxi\_a <dbl> 87.33254, 89.70728, 87.69115, 83.27948, 54.07928,~  
#> $ adolaxi\_b <dbl> 6.808460, 3.731862, 3.130978, 6.722017, 11.252222~  
#> $ adolaxi\_a <dbl> 90.58151, 94.82266, 95.01616, 88.25488, 84.90963,~  
#> $ adulimc\_b <dbl> 2.827968, 2.997737, 3.090363, 3.509290, 4.249122,~  
#> $ adulimc\_a <dbl> 30.94736, 34.18317, 30.95282, 30.33687, 29.81214,~  
#> $ adulimc\_obesg\_i <dbl> 20.38145, 19.11304, 21.55658, 19.53297, 18.93734,~  
#> $ adol\_ultra <dbl> 0.7261478, 0.7709625, 0.9322236, 0.9506270, 0.876~  
#> $ adul\_ultra <dbl> 0.6446387, 0.6485097, 0.7613809, 0.7736857, 0.726~  
#> $ cri59\_ultra <dbl> 0.8811275, 0.6702381, 0.9743239, 0.9236111, 0.822~  
#> $ ido\_ultra <dbl> 0.6688215, 0.7586935, 0.6887834, 0.8116582, 0.553~

# Análise Multivariada

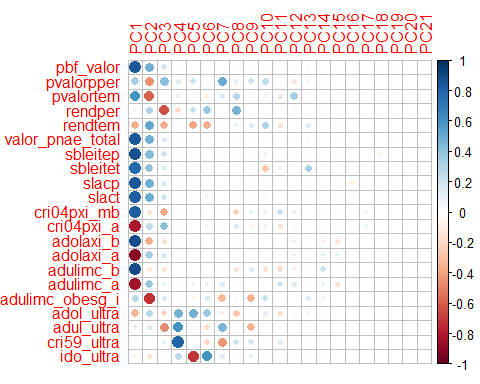
da <- base\_multivariada\_final #%>%   
 # select(pbf\_valor:valor\_pnae\_total,sbleitep,cri04pxi\_mb,adulimc\_obesg\_i,  
 # cri59\_ultra,adul\_ultra)  
  
da\_pad <- decostand(da[-1] ,   
 method = "standardize",  
 na.rm=TRUE)  
row.names(da\_pad) <- base\_multivariada\_final$nome\_regiao\_imediata  
da\_pad\_euc<-vegdist(da\_pad,"euclidean",na.rm=TRUE)   
da\_pad\_euc\_ward<-hclust(da\_pad\_euc, method="ward.D")  
grupo<-cutree(da\_pad\_euc\_ward,5)  
n\_grupo <- length(unique(grupo))  
ggdendrogram(da\_pad\_euc\_ward, rotate = TRUE, size = 2)



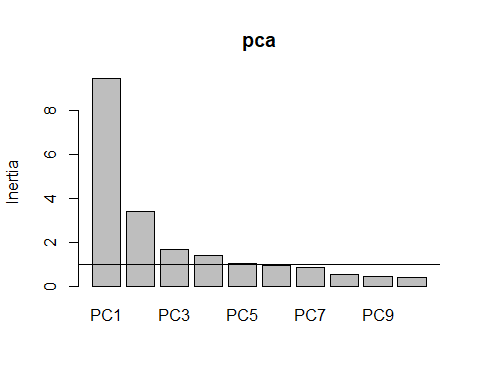
cor\_matrix <- cor(da\_pad,use = "na.or.complete")  
corrplot(cor\_matrix, method="ellipse")



da\_pad <- da\_pad %>%   
 mutate(across(where(is.numeric), function(x) {  
 med <- mean(x,na.rm=TRUE)  
 x[is.na(x)] <- med  
 x  
 }))  
  
pca <- prcomp(da\_pad,  
 scale=T)  
df<- da\_pad  
# Autovalores  
eig<-pca$sdev^2  
print(round(eig,3))  
#> [1] 9.446 3.415 1.646 1.399 1.038 0.951 0.856 0.549 0.418 0.390 0.273 0.225  
#> [13] 0.177 0.099 0.067 0.021 0.015 0.009 0.003 0.002 0.000  
ve<-eig/sum(eig)  
print(round(ve,4))  
#> [1] 0.4498 0.1626 0.0784 0.0666 0.0494 0.0453 0.0408 0.0261 0.0199 0.0186  
#> [11] 0.0130 0.0107 0.0084 0.0047 0.0032 0.0010 0.0007 0.0004 0.0001 0.0001  
#> [21] 0.0000  
print(round(cumsum(ve),4)\*100)  
#> [1] 44.98 61.25 69.08 75.75 80.69 85.22 89.30 91.91 93.90 95.76  
#> [11] 97.06 98.13 98.97 99.44 99.77 99.86 99.93 99.98 99.99 100.00  
#> [21] 100.00  
mcor<-cor(df,pca$x)  
corrplot(mcor)

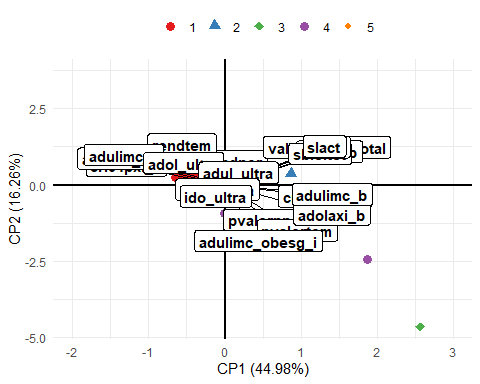


screeplot(pca)  
abline(h=1)



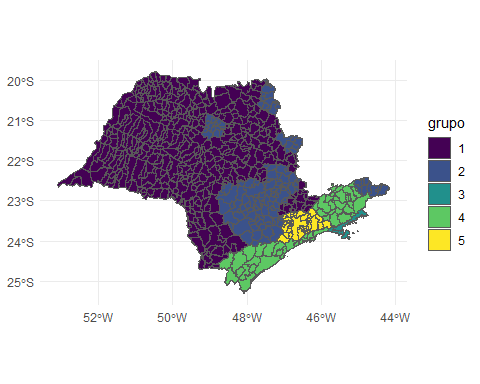
pc1V<-cor(df,pca$x)[,1]/sd(cor(df,pca$x)[,1])  
pc2V<-cor(df,pca$x)[,2]/sd(cor(df,pca$x)[,2])  
pc3V<-cor(df,pca$x)[,3]/sd(cor(df,pca$x)[,3])  
pc1c<-pca$x[,1]/sd(pca$x[,1])  
pc2c<-pca$x[,2]/sd(pca$x[,2])  
pc3c<-pca$x[,3]/sd(pca$x[,3])  
nv<-ncol(df)

bip<-data.frame(pc1c,pc2c,pc3c,grupo=as.factor(grupo))  
texto <- data.frame(x = pc1V, y = pc2V,z = pc3V,label = names(df)  
)  
  
bip %>%   
 ggplot(aes(x=pc1c, y=pc2c))+  
 geom\_point() +  
 geom\_point(aes(shape = grupo, color = grupo), size = 3) + theme\_minimal()+  
 scale\_shape\_manual(values=16:(15+n\_grupo)) +  
 scale\_colour\_brewer(palette = "Set1") +  
 geom\_vline(aes(xintercept=0),  
 color="black", size=1) +  
 geom\_hline(aes(yintercept=0),  
 color="black", size=1) +  
 annotate(geom="segment",  
 x=rep(0,length(df)),  
 xend=texto$x,  
 y=rep(0,length(df)),  
 yend=texto$y,color="black",lwd=.5) +  
 geom\_label(data=texto,aes(x=x,y=y,label=label),  
 color="black",angle=0,fontface="bold",size=4,fill="white") +  
 labs(x=paste("CP1 (",round(100\*ve[1],2),"%)",sep=""),  
 y=paste("CP2 (",round(100\*ve[2],2),"%)",sep=""),  
 color="",shape="") +  
 theme(legend.position = "top") +  
 coord\_cartesian(xlim=c(-2,3))



ck<-sum(pca$sdev^2>=1)  
tabelapca<-vector()  
for( l in 1:ck) tabelapca<-cbind(tabelapca,mcor[,l])  
colnames(tabelapca)<-paste(rep(c("PC"),ck),1:ck,sep="")  
pcat<-round(tabelapca,3)  
tabelapca<-tabelapca[order(abs(tabelapca[,1])),]  
print(tabelapca)  
#> PC1 PC2 PC3 PC4 PC5  
#> cri59\_ultra -0.06166675 -0.0587706 0.11674260 0.800237457 -0.018905011  
#> ido\_ultra -0.07474847 -0.1466803 -0.02179622 0.260893036 -0.714807391  
#> rendper 0.07621323 0.3112646 -0.64963115 -0.193382493 0.233935925  
#> adul\_ultra 0.11361862 0.1598745 -0.47067030 0.606476770 -0.069986605  
#> adulimc\_obesg\_i 0.27771483 -0.7253662 0.17229520 0.026951986 -0.074940805  
#> adol\_ultra -0.34256116 0.2841628 -0.21683074 0.476211424 0.488427178  
#> pvalorpper 0.34948840 -0.4518773 0.42952152 0.155500617 0.210251202  
#> rendtem -0.35426014 0.5254450 -0.36343613 -0.063191025 -0.403692981  
#> pvalortem 0.59756766 -0.5903234 -0.03479457 0.119038421 0.063081692  
#> sbleitet 0.78725419 0.4057562 0.13721247 -0.002228666 0.045557066  
#> cri04pxi\_a -0.81572867 0.2524467 0.42303677 0.064385498 -0.002425975  
#> slact 0.82479585 0.5021359 0.19956250 0.045539730 -0.026375732  
#> cri04pxi\_mb 0.82663060 -0.1464017 -0.37497146 -0.059970996 -0.009052939  
#> adulimc\_a -0.83447684 0.3902182 0.09000211 -0.034926265 0.077241310  
#> pbf\_valor 0.84193862 0.4866824 0.18848093 0.034268193 -0.017637716  
#> valor\_pnae\_total 0.84406990 0.4891894 0.17515148 0.034369991 -0.025665916  
#> slacp 0.84423408 0.4898717 0.16558931 0.024544043 -0.024273352  
#> sbleitep 0.86519472 0.4324519 0.19283690 0.027496461 -0.033965389  
#> adolaxi\_b 0.88487624 -0.3792754 -0.17102043 -0.025997288 0.015325509  
#> adulimc\_b 0.88736365 -0.1211328 -0.14629998 -0.007390045 0.001715536  
#> adolaxi\_a -0.90608363 0.3412086 0.16126936 0.014574515 0.003723985

df\_grupo <- data.frame(nome\_regiao\_imediata = row.names(da\_pad), grupo)  
  
df\_grupo <- left\_join(df\_nomes %>%   
 select(id\_municipio, nome, nome\_regiao\_imediata),  
 df\_grupo,  
 by ="nome\_regiao\_imediata")  
  
d\_sf\_municipio <- st\_read("shp/35MUE250GC\_SIR.shp", quiet = TRUE)  
  
d\_sf\_municipio <- d\_sf\_municipio %>%  
 rename(id\_municipio = CD\_GEOCMU) %>%  
 inner\_join(df\_grupo %>%  
 relocate(id\_municipio), "id\_municipio") %>%   
 mutate(grupo = as.factor(grupo))  
  
ggplot(d\_sf\_municipio) +  
 geom\_sf(aes(fill = grupo))+  
 theme\_minimal() +  
 scale\_fill\_viridis\_d()



n\_grupo <- length(unique(grupo))  
nome <- row.names(da\_pad)  
for(i in 1:n\_grupo){  
 print("===============")  
 print(paste0("Grupo ",i,""))  
 print("===============")  
 print(paste(nome[grupo == i],collapse = "; "))  
 cat("\n")  
}  
#> [1] "==============="  
#> [1] "Grupo 1"  
#> [1] "==============="  
#> [1] "Adamantina - Lucélia; Andradina; Araraquara; Araçatuba; Assis; Avaré; Barretos; Bauru; Birigui - Penápolis; Bragança Paulista; Dracena; Fernandópolis; Itapeva; Ituverava; Jales; Jaú; Jundiaí; Lins; Marília; Ourinhos; Piraju; Presidente Epitácio-Presidente Venceslau; Presidente Prudente; Ribeirão Preto; Rio Claro; Santa Fé do Sul; São Carlos; São Joaquim da Barra ¿ Orlândia; São José do Rio Preto; São João da Boa Vista; Tupã; Votuporanga"  
#>   
#> [1] "==============="  
#> [1] "Grupo 2"  
#> [1] "==============="  
#> [1] "Amparo; Araras; Botucatu; Campinas; Catanduva; Cruzeiro; Franca; Itapetininga; Limeira; Mogi Guaçu; Piracicaba; Sorocaba; São José do Rio Pardo - Mococa; Tatuí"  
#>   
#> [1] "==============="  
#> [1] "Grupo 3"  
#> [1] "==============="  
#> [1] "Caraguatatuba - Ubatuba - São Sebastião"  
#>   
#> [1] "==============="  
#> [1] "Grupo 4"  
#> [1] "==============="  
#> [1] "Guaratinguetá; Registro; Santos; São José dos Campos; Taubaté - Pindamonhangaba"  
#>   
#> [1] "==============="  
#> [1] "Grupo 5"  
#> [1] "==============="  
#> [1] "São Paulo"