Q5-a

```
bf_pvalue <- p.adjust(diet_pvalue$P.value, 'bonferroni')
data.frame(Variable=diet_pvalue$Dietary.Variable, Bonferroni.P = bf_pvalue)
```

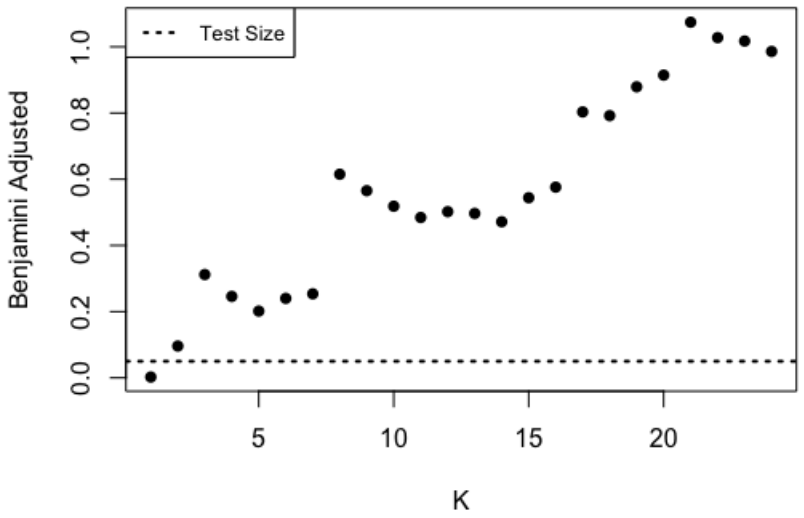
	Variable	Bonferroni.P
1	Total calories	0.0024
2	Olive oil	0.1920
3	Whole milk	0.9360
4	White meat	0.9840
5	Proteins	1.0000
6	Nuts	1.0000
7	Cereals and pasta	1.0000
8	White fish	1.0000
9	Butter	1.0000
10	Vegetables	1.0000
11	Skim milk	1.0000
12	Red meat	1.0000
13	Fruit	1.0000
14	Eggs	1.0000
15	Blue fish	1.0000
16	Carbohydrates	1.0000
17	Potatoes	1.0000
18	Bread	1.0000
19	Fats	1.0000
20	Sweets	1.0000
21	Dairy products	1.0000
22	Semi-skim milk	1.0000
23	Processed meat	1.0000
24	Total meat	1.0000

This table shows adjusted p-values for each dietary variables by Bonferroni method.

Compare adjusted p-values to test size $\alpha = 0.05$. We can see each variables' adjusted p-value is larger than test size except for "Total calories". Therefore, we may conclude that only the p-value of total calories provided significant evidence for association between total calories and mammographic density.

Q5-b

```
m <- nrow(diet_pvalue)
ordered_pvalue <- diet_pvalue[order(diet_pvalue$P.value),]
ben_pvalue <- rep(NA, m)
k_reject <- 0
for (ii in 1:m) {
  adj_pvalue <- ordered_pvalue$P.value[ii] * m / ii
  ben_pvalue[ii] <- adj_pvalue
  if (adj_pvalue < 0.05) {
    k_reject <- ii
  }
}
> ordered_pvalue[1:k_reject,]
  Dietary.Variable P.value
1   Total calories   1e-04
```



The R code above calculated the larges k such that $P_k \leq \frac{k}{m} FDR$, of which $k = 1$.

Both calculation and the plot show that given FDR $\alpha = 0.05$, the largest k such that $P_k \leq \frac{k}{m}\alpha$ is equal to 1 (in the plot, k=1 is the only point that has adjusted p-value less than FDR). So we can reject all H_{0i} for $i = 1, ...k$, of which in this case $H_{0,1}$ is the only null hypothesis that can be rejected.

Therefore, we may conclude that observed data provides significant evidence that "total calories" is associated with mammographic density, but fail to provide significant evidence of associations between other dietary variables and mammographic density.

(R code in Appendix)