**Appendix:**

**Appendix A. Nutritional pattern**

Factor analysis was used to obtain a nutritional pattern. Four main dietary patterns were identified, including: "western", "Mediterranean", "animal fat", and "fast food". the "Western diet," which included fried foods, potatoes, legumes, hydrogenated vegetable oils, red meat, pickles, and rice. The Mediterranean diet included consumption of non-hydrogenated vegetable oils, fruits, poultry, fish, vegetables, and olive oil. "Animal fat diet" which was characterized by a high intake of cream, whole milk, butter, and meat. And the "fast food diet" which contains lots of burgers, sausages, pizzas, sweets, and carbonated drinks.

**Table A**. Factor loading matrix for dietary patterns

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Food | Western diet  | Mediterranean diet | Animal fat diet | Fast food diet |
| Fried food | 0.56 | - | - | - |
| Potato | 0.56 | - | - | - |
| Legumes | 0.52 | - | - | - |
| Hydrogenated | 0.51 | -0.44 | - | - |
| Red meat | 0.50 | - | - | - |
| Pickle | 0.45 | - | - | - |
| Rice | 0.45 | - | - | - |
| Non-hydrogenated vegetable oil | - | 0.59 | - | - |
| Fruits | 0.40 | 0.58 | - | - |
| Poultry | - | 0.55 | - | - |
| Fish | - | 0.54 | - | - |
| Vegetables | 0.47 | 0.49 | - | - |
| Olive oil |  | 0.41 | - | - |
| Bread | 0.26 | -0.34 | - | - |
| Cream | - | - | 0.69 | - |
| Whole milk | - | - | 0.59 | - |
| Ghee | - | - | 0.45 | - |
| Butter | 0.22 | - | 0.45 | 0.21 |
| Organ meat | - | - | 0.45 | - |
| Liver | - | - | 0.37 | 0.32 |
| Tallow | - | - | 0.33 | - |
| Dry fruits | 0.25 | - | 0.31 | - |
| Jam | 0.24 | - | 0.28 | 0.25 |
| Soy protein | - | - | - | - |
| Industrial fruit juice | - | - | - | - |
| Hamburger | - | - | - | 0.67 |
| Sausages | - | - | - | 0.66 |
| Pizza | -- | - | - | 0.47 |
| Sweet | - | - | - | 0.46 |
| Carbonatedbeverages | - | - | - | 0.42 |
| Nuts | 0.22 | - | - | 0.36 |
| Canned foods | - | - | 0.21 | 0.27 |

**Appendix B. WinBUGS code BSEM**

model{

 for( i in 1 : N ) {

 for( j in 1 : 22 ) {

 y[i , j] <- yy[i , j]

 }

 x1[i] <- yy[i , 20]

 x2[i] <- yy[i , 21]

 x3[i] <- yy[i , 22]

 for( j in 1 : 1 ) {

 y[i , j] ~ dnorm(mu[i , j], 1)C(y[i , j],y[i , j])

 }

 for( j in 2 : 19 ) {

 y[i , j] ~ dnorm(mu[i , j], psi[j])

 ephat[i , j] <- y[i , j] - mu[i , j]

 }

 mu[i , 1] <- u[1] + beta[1] \* x1[i] + ta[1] \* x2[i] + eta[i]

 mu[i , 2] <- u[2] + beta[2] \* x1[i] + ta[2] \* x2[i] + xi[i , 1]

 mu[i , 3] <- u[3] + beta[3] \* x1[i] + ta[3] \* x2[i] + lam[1] \* xi[i , 1]

 mu[i , 4] <- u[4] + beta[4] \* x1[i] + ta[4] \* x2[i] + lam[2] \* xi[i , 1]

 mu[i , 5] <- u[5] + beta[5] \* x1[i] + ta[5] \* x2[i] + lam[3] \* xi[i , 1]

 mu[i , 6] <- u[6] + beta[6] \* x1[i] + ta[6] \* x2[i] + xi[i , 2]

 mu[i , 7] <- u[7] + beta[7] \* x1[i] + ta[7] \* x2[i] + lam[4] \* xi[i , 2]

 mu[i , 8] <- u[8] + beta[8] \* x1[i] + ta[8] \* x2[i] + lam[5] \* xi[i , 2]

 mu[i , 9] <- u[9] + beta[9] \* x1[i] + ta[9] \* x2[i] + xi[i , 3]

 mu[i , 10] <- u[10] + beta[10] \* x1[i] + ta[10] \* x2[i] + lam[6] \* xi[i , 3]

 mu[i , 11] <- u[11] + beta[11] \* x1[i] + ta[11] \* x2[i] + lam[7] \* xi[i , 3]

 mu[i , 12] <- u[12] + beta[12] \* x1[i] + ta[12] \* x2[i] + xi[i , 4]

 mu[i , 13] <- u[13] + beta[13] \* x1[i] + ta[13] \* x2[i] + lam[8] \* xi[i , 4]

 mu[i , 14] <- u[14] + beta[14] \* x1[i] + ta[14] \* x2[i] + xi[i , 5]

 mu[i , 15] <- u[15] + beta[15] \* x1[i] + ta[15] \* x2[i] + lam[9] \* xi[i , 5]

 mu[i , 16] <- u[16] + beta[16] \* x1[i] + ta[16] \* x2[i] + lam[10] \* xi[i , 5]

 mu[i , 17] <- u[17] + beta[17] \* x1[i] + ta[17] \* x2[i] + lam[11] \* xi[i , 5]

 mu[i , 18] <- u[18] + beta[18] \* x1[i] + ta[18] \* x2[i] + xi[i , 6]

 mu[i , 19] <- u[19] + beta[19] \* x1[i] + ta[19] \* x2[i] + lam[12] \* xi[i , 6]

 xi[i , 1:6] ~ dmnorm(u0[1:6], phi[1:6 , 1:6])

 eta[i] ~ dnorm(nu[i], psd)

 nu[i] <- ta1[1] \* x1[i] + ta1[2] \* x2[i] + ta1[3] \* x3[i] + gam[4] \* xi[i , 1] + gam[5] \* xi[i , 2] + gam[6] \* xi[i , 3] + gam[7] \* xi[i , 4] + gam[8] \* xi[i , 5] + gam[9] \* xi[i , 6]

 dthat[i] <- eta[i] - nu[i]

 }

 for( j in 1 : 19 ) {

 u[j] ~ dnorm(0, 4)

 }

 lam[1] ~ dnorm(0, 4)

 lam[2] ~ dnorm(0, 4)

 lam[3] ~ dnorm(0, 4)

 lam[4] ~ dnorm(0, 4)

 lam[5] ~ dnorm(0, 4)

 lam[6] ~ dnorm(0, 4)

 lam[7] ~ dnorm(0, 4)

 lam[8] ~ dnorm(0, 4)

 lam[9] ~ dnorm(0, 4)

 lam[10] ~ dnorm(0, 4)

 lam[11] ~ dnorm(0, 4)

 lam[12] ~ dnorm(0, 4)

 gam[1] ~ dnorm(0, psd)

 gam[2] ~ dnorm(0, psd)

 gam[3] ~ dnorm(0, psd)

 gam[4] ~ dnorm(0, psd)

 gam[5] ~ dnorm(0, psd)

 gam[6] ~ dnorm(0, psd)

 gam[7] ~ dnorm(0, psd)

 gam[8] ~ dnorm(0, psd)

 gam[9] ~ dnorm(0, psd)

 for( j in 1 : 19 ) {

 psi[j] ~ dgamma(0.01, 0.01)

 sigma[j] <- 1 / psi[j]

 }

 psd ~ dgamma(0.01, 0.01)

 sigd <- 1 / psd

 phi[1:6 , 1:6] ~ dwish(R[1:6 , 1:6], 8)

 phx[1:6 , 1:6] <- inverse(phi[1:6 , 1:6])

 ta1[1] <- gam[1]

 ta1[2] <- gam[2]

 ta1[3] <- gam[3]

 for( j in 1 : 6 ) {

 gamma[j] <- gam[3 + j]

 }

 for( j in 1 : 19 ) {

 psiepsilon[j] <- sigma[j]

 }

 psidelta <- sigd

}

**Appendix C: An example of Golman Robin test, convergence diagrams, and Monte Carlo** **error**

**C1: Golman Robin test**

 ----------------------------80% interval----------------------------

 Unnormalized Normalized as plotted

iteration range of pooled mean within of pooled mean within BGR ratio

 chains chain chains chain

1051—1100 0.1829 0.1665 0.7949 0.7234 1.099

1101—1200 0.1949 0.1899 0.8468 0.825 1.026

1151—1300 0.2206 0.2212 0.9584 0.9611 0.9972

1201—1400 0.2301 0.2277 1.0 0.9895 1.011

1251—1500 0.2062 0.1926 0.8961 0.8368 1.071

1301—1600 0.1882 0.1714 0.8177 0.7449 1.098

1351—1700 0.1582 0.1464 0.6875 0.636 1.081

1401—1800 0.1688 0.1592 0.7334 0.6919 1.06

1451—1900 0.1783 0.1682 0.7749 0.7311 1.06

1501—2000 0.181 0.1663 0.7864 0.7225 1.088

**C2: onvergence diagrams for the first 1000 updates (trace plot)**

|  |
| --- |
| Model |
| MC error | **MC** **error** |
| Age-> total CVD | 5.30E-05 | **Lipids->** HDL**Lipids->** LDL**Lipids->** Tg**Lipids->** Cho | -1.15E-031.66E-031.91E-03 |
| Family history -> total CVD | 1.40E-03 | **Anthropometric->** HC**Anthropometric->** WC**Anthropometric->** BMI | -1.95E-041.12E-04 |
| Sex -> total CVD | 2.04E-03 | **Unhealthy life style->** smoking**Risky behavior ->**  depression and anxiety**Risky behavior ->** unhealthy diet behavior | -5.87E-035.58E-03 |
| Lipids -> total CVD | 2.15E-03 | **Comorbidities->** Blood sugar**Comorbidities->** Blood pressure | -8.99E-05 |
| Anthropometric -> total CVD | 1.93E-03 | **Quality of life->** Environmental Heath**Quality of life->** Social Relationship**Quality of life->** Mental Health**Quality of life->** Physical Health | -2.96E-042.50E-042.76E-04 |
| risky behavior-> total CVD | 4.38E-03 | **Healthy lifestyle component->** physical activity**Healthy lifestyle component->** Healthy diet behavior | -9.92E-04 |
| Comorbidities -> total CVD ->Cvd | 2.44E-04 | **Lipids**<-> Anthropometric**Lipids**<-> Risky behavior**Lipids**<-> Comorbidities**Lipids**<-> Quality of life**Lipids**<->healthy lifestyle component | 8.93E-028.18E-024.98E-027.13E-026.79E-02 |
| Quality of life -> total CVD | 1.48E-03 | **Anthropometric**<-> Risky behavior**Anthropometric**<-> Comorbidities**Anthropometric**<-> Quality of life**Anthropometric**<-> healthy lifestyle component | 7.57E-024.94E-026.93E-026.65E-02 |
| Healthylifestyle -> total CVD | 1.14E-03 | **Risky behavior** <-> Comorbidities**Risky behavior** <-> Quality of life**Risky behavior** <-> healthy lifestyle component | 4.40E-026.39E-026.13E-02 |
|  |  | **Comorbidities**<-> Quality of life**Comorbidities**<-> healthy lifestyle component | 4.00E-024.03E-02 |
|  |  | **Quality of life**<-> healthy lifestyle component | 5.32E-02 |

**C3:Table B. Monte Carlo error for total CVD**