

Chapter 3

Preliminary Data Analysis

3.1 Variables

The variables of interest for this study comprise 12 determinants and one outcome. Sex is a binary determinant. Age and level/year are ordinal determinants. Religion, parent status, school, birth place, school district and relation are nominal determinants.

Father's salary, mother's salary and parent's salary are continuous determinants. BMI is the continuous outcome. Their roles and data types are shown in Table 3.1.

Variable	Type	Role
Sex	binary	determinant
Age	ordinal (11)	determinant
Religion	nominal (3)	determinant
Parent Status	nominal (7)	determinant
Level /Year	ordinal (9)	determinant
School	nominal (17)	determinant
Birth Place	nominal (24)	determinant
School District	nominal (12)	determinant
Relation	nominal (8)	determinant
Father's Salary	continuous	determinant
Mother's Salary	continuous	determinant
Parent's Salary	continuous	determinant
BMI	continuous	outcome

Table 3.1: Variable types and roles in this study

In this study, there were 9393 students in public high schools in Pattani province in 2004 whose heights and weights are available in the database. The total number of students attending high schools in 2004 was 9537, so our study sample comprises 98.5% of the total.

3.2 Distributions of Determinants

The frequency distributions of the 12 determinants are described in this section.

Sex

With reference to sex, 4965 students were female (52.9%) and 4428 were male (47.1%) as shown in Table 3.2. Since the proportion of males in the population aged 10-19 in Pattani province is very close to 50%, this indicates that males are slightly less likely to attend school.

Variable	Label	n	percent
Sex	1=male	4428	47.14
	2=female	4965	52.86

Table 3.2: Distribution of sex

Age

The ages of the students ranged from 12 to 22 years as shown in Table 3.3. There were fewer students aged 12 than aged 13 because students attending high school are mostly aged 13. There were fewer older students because most students complete their high school education before turning 19.

Variable	Label	n	percent
Age	12	519	5.53
	13	1634	17.40
	14	2064	21.97
	15	1750	18.63
	16	1192	12.69
	17	1135	12.08
	18	883	9.40
	19	162	1.72
	20	41	0.44
	21	8	0.09
	22	5	0.05

Table 3.3: Distribution of age

Religion

There are three groups of the student's religion. There were 5444 Buddhists (58.0%), 3933 Muslim (41.9%), and 16 others belief (0.2%), as shown in Table 3.4. Since Pattani province is 81% Muslim, this indicates that most Muslim students do not attend public high schools in Pattani province.

Variable	Label	n	percent
Religion	1=Buddhist	5444	57.96
	2=Muslim	3933	41.87
	3=Others	16	0.17

Table 3.4: Distribution of religion

Parent Status

Parent status refers to the relationship between a student's father and mother. There were 8079 (86.0%) living together, 429 (4.6%) divorced, 364 (3.9%) where the father was deceased, 321 (3.4%) separated, 114 (1.2%) where the mother was deceased, 59 (0.6%) with a step-parent, and 27 (0.3%) other possibilities, as shown in Table 3.5.

Variable	Label	n	percent
Parent Status	0=together	8079	86.01
	1=separated	321	3.42
	2=divorced	429	4.57
	3=father dead	364	3.88
	4=mother dead	114	1.21
	5=step-parent	59	0.63
	6=other	27	0.29

Table 3.5: Distribution of parent status

Level/ year

The levels and years of the students comprised Mattayom1 to Mattayom6 for all schools and Vocation1 to Vocation3 for two schools (Wuttichaiwittaya and Phokiriratsuksa).

As Table 3.6 shows, students studied in Mattayom1-3 were as in almost twice as

Mattayom4–6. Vocation1–3 are equivalent to Mattayom4–6, and most such students prefer technical colleges.

Variable	Label	n	percent
Level /Year	11=Mattayom1	1893	20.15
	12=Mattayom2	2101	22.37
	13=Mattayom3	1986	21.14
	21=Mattayom4	1159	12.34
	22=Mattayom5	1044	11.11
	23=Mattayom6	1124	11.97
	31=Vocation1	31	0.33
	32=Vocation2	18	0.19
	33=Vocation3	37	0.39

Table 3.6: Distribution of level/year

School District

Pattani province has 12 districts. The distribution of students to district is shown in Table 3.7.

Variable	Label	n	percent
School District	1=muang	4797	51.07
	2=khokPho	1317	14.02
	3=nongjik	322	3.43
	4=panare	685	7.29
	5=mayor	322	3.43
	6=tungYungDang	138	1.47
	7=saiburi	514	5.47
	8=maiKan	139	1.48
	9=yaring	304	3.24
	10=yarang	457	4.87
	11=khapor	245	2.61
	12=maeLan	153	1.63

Table 3.7: Distribution of school district

Five districts have two schools each. These are Muang (Pattani city) district (Dechapattanayanukoon and Benjamarachootid, with a total of 4797 (51.1%) students), Khokpho (Phokiriratsuksa and Ratchamunirangsarit, with a total of 14.0%), Nongjik (Patoomkongka-anusorn and Yabeebannawit, with 3.4%), Panare (Wuttichaiwittaya and

Thakarnwittayakarn with 7.3%), and Yarang (Pratoophowittaya and Sanorphityakhom, with 4.9%). The other seven districts, Mayor, Tungyangdang, Saiburi, Maikan, Yaring, Khapor, and Maelan, each have one school, Siriratsamakki, Thungyangdangpittayakom, Saiburichangprachakarn, Maikankittiwit, Suwanpaiboon, Wangkaporpittayakom, and Maclarnwittaya, respectively.

School

There are 17 public high schools in Pattani province. As Table 3.8 shows, the largest two are Dechapattanayanukoon and Benjamarachootid with 2868 (30.5%) and 1929 (20.5%) students, respectively, both located in Sabarang sub-district of Pattani city. The third largest is Phokiriratsuksa in Khokpho district with 942 (10.0%) students. The two smallest schools are Maikankittiwit in Mai Kan district with 139 (1.5%) students, and Thungyangdangpittayakom in Thungyangdang district with 138 (1.5%) students.

Variable	Label	n	percent
School	1=Benjama	1929	20.54
	2=Decha	2868	30.53
	3=Suwan	304	3.24
	4=Wuttichai	285	3.03
	5=Thakarm	400	4.26
	6=Saiburi	514	5.47
	7=Maikan	139	1.48
	8=Wangkapor	245	2.61
	9=Patoom	173	1.84
	10=Yabeebannawit	149	1.59
	11=Phokiriratsuksa	942	10.03
	12=Ratchamunee	375	3.99
	13=Maclarnwittaya	153	1.63
	14=Pratoophowittaya	212	2.26
	15=Sanorphityakhom	245	2.61
	16=Siriratsamakki	322	3.43
	17=ThungYangDang	138	1.47

Table 3.8: Distribution of schools

Birth Place

The subdistricts where the students were born are recorded, but for simplicity we classified the birth places of the students into just 24 areas, comprising six in Pattani city, the remaining 11 districts in Pattani Province, its three neighbouring provinces (Yala, Songkla and Naratiwat), the other province of southern Thailand with a large number of students (NakornSriTammarat), the rest of southern Thailand, Bangkok and three surrounding provinces, and the rest of Thailand. The distribution of students to these areas is shown in Table 3.9. Sabarang sub-district had the largest contribution (17.8%), followed by Yala province (12.3%) and KhokPho district (11.2%).

Variable	Label	n	percent
BirthPlace	1=sabarang	1672	17.80
	2=arnohru	229	2.44
	3=jabangTiko	83	0.88
	4=bana	186	1.98
	5=rusamilae	196	2.09
	6=muangOther	188	2.00
	7=khokPho	1054	11.22
	8=nongjik	417	4.44
	9=panare	613	6.53
	10=mayor	379	4.03
	11=tungYangDang	105	1.12
	12=saiburi	485	5.16
	13=maikan	129	1.37
	14=yaring	506	5.39
	15=yarang	437	4.65
	16=kapor	139	1.48
	17=maclan	117	1.25
	18=yala	1157	12.32
	19=songkla	454	4.83
	20=naratiwat	196	2.09
	21=nakornSriTammarat	116	1.23
	22=southOther	153	1.63
	23=prov10-15, 70-77	171	1.82
	24=other	211	2.25

Table 3.9: Distribution of birth place

Relation

Table 3.10 shows the distribution of the persons nominated as the guardians of the students. Most students nominated their mother (possibly stepmother) (30.2%) or their brother (27.4%) as their guardian.

Variable	Label	n	percent
relation	1=father	1266	13.48
	2=mother	2840	30.24
	3=brother	2570	27.36
	4=sister	1177	12.53
	5=grandfather	677	7.21
	6=grandmother	383	4.08
	7=uncle	342	3.64
	8=auntie	138	1.47

Table 3.10: Distribution of guardian

Parental salaries

Figure 3.1 shows the distributions of the fathers', mothers' and combined parents' monthly salaries in baht. The distributions are skewed, and some are coded as 0s. These 0s are present in cases where the information about the parents' salaries is not provided by the student. This might happen if the parent was not working or out of the country or deceased, or also because the student did not know or was not prepared to divulge the information. For the fathers, 1977 (21.0%) were in this category, as were 2698 (28.7%) of the mothers, and 925 (9.8%) of both parents that shown as Table 3.11.

Figure 3.1 also shows the distribution of the combined parents' salaries after taking the transformation $\ln(1+\text{salary})$ to remove the skewness in the distribution, without omitting the 0s. Apart from these 0s the distribution is approximately symmetric.

Figure 3.2 shows the same salary distributions after omitting the cases where the combined parent salaries were coded as 0s.

Variable name	Size	Graph	Minimum	Maximum	Mean	StDev
fatherSalary	9393		0	300,000	6,103.222	8,481.566
motherSalary	9393		0	300,000	4,193.277	7,078.583
parentSalary	9393		0	300,000	8,355.366	10,672.772
lnParentSalary1	9393		0	12.612	7.872	2.734

Figure 3.1: Distribution of parental salaries

Variable name	Size	Graph	Minimum	Maximum	Mean	StDev
fatherSalary	8468		0	300,000	6,765.198	8,676.726
motherSalary	8468		0	300,000	4,611.761	7,318.880
parentSalary	8468		150	300,000	9,268.062	10,857.823
lnParentSalary1	8468		5.017	12.612	8.731	0.884

Figure 3.2: Distribution of parental salaries with zero combined salaries omitted

3.3 Distribution of Outcome

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is calculated as the weight in kilograms divided by the square of the height in meters.

As Figure 3.3 shows, the BMIs of the students ranged from 10.03 to 42.97, and they have a right-skewed distribution with skewness coefficient 1.49 and kurtosis coefficient 4.49. Transforming the data by taking logarithms does not remove this skewness, only reducing the coefficient to 0.66. However, taking the transformation $\ln(\text{BMI}-8)$ reduces

the skewness coefficient to 0.10. It is possible to reduce the skewness coefficient further by using $\ln(\text{BMI}-8)$, but as a result the kurtosis coefficient increases.

In further analysis of body mass index, we use the transformation $\ln(\text{BMI}-8)$. This transformation was used by Mo-suwan, Tongkumchum and Puetpaiboon (2000) in their analysis of BMIs of Hat Yai schoolchildren.

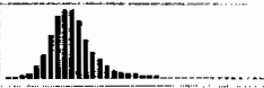
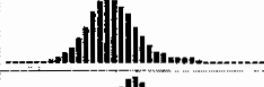
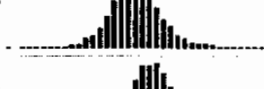
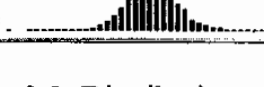
Variable name	Size	Graph	Minimum	Maximum	Mean	StDev	Skewness	Kurtosis
BMI	9393		10.025	42.969	19.029	3.299	1.493	4.490
$\ln\text{BMI}$	9393		2.305	3.760	2.932	0.162	0.662	1.531
$\ln\text{BMI} - 6$	9393		1.392	3.610	2.538	0.236	0.326	1.201
$\ln\text{BMI} - 8$	9393		.705	3.554	2.360	0.281	0.102	1.335

Figure 3.3: Distribution of BMI after various transformations

3.4 Associations between Determinants

In this section we examine the associations between the determinants. Figure 3.4 shows the association between sex and age group. Age group “13” actually comprises students aged 12 and 13, and age group “18” comprises students aged 18 or more. There are more females aged 16 and 17, and more males aged below 15.

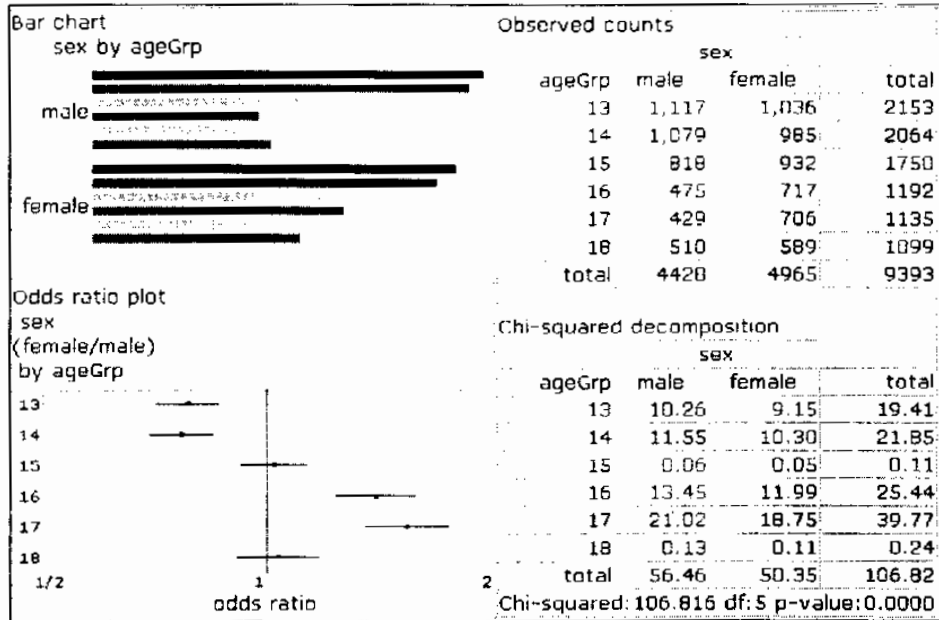


Figure 3.4: Association between sex and age group

Figure 3.5 shows the association between sex and religion group. The other belief had fewer than Islam or Buddha. The non-Muslim students are grouped together. There is no association between religion group and sex.

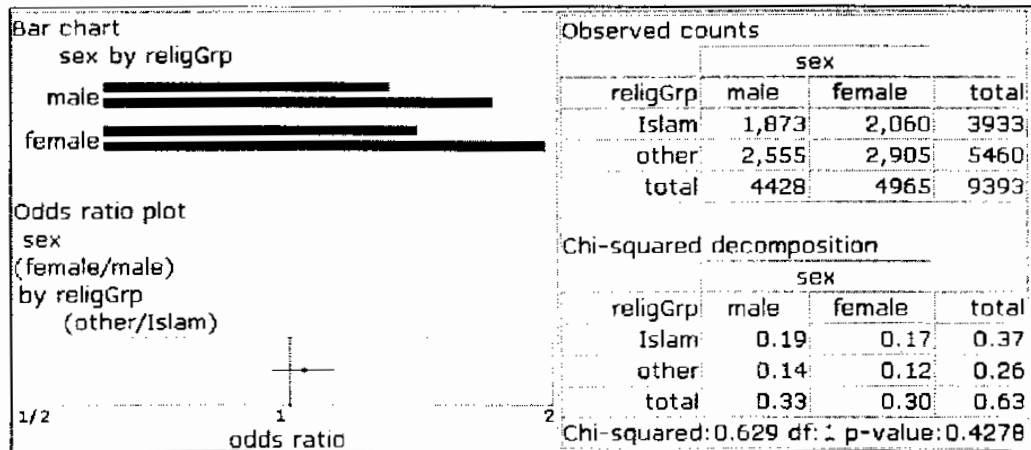


Figure 3.5: Association between sex and religion group

Figure 3.6 shows the association between sex and level/year. There are slightly more males in Mattayom1 and 2, and more females in Mattayom4-6 and Vocation1-3.

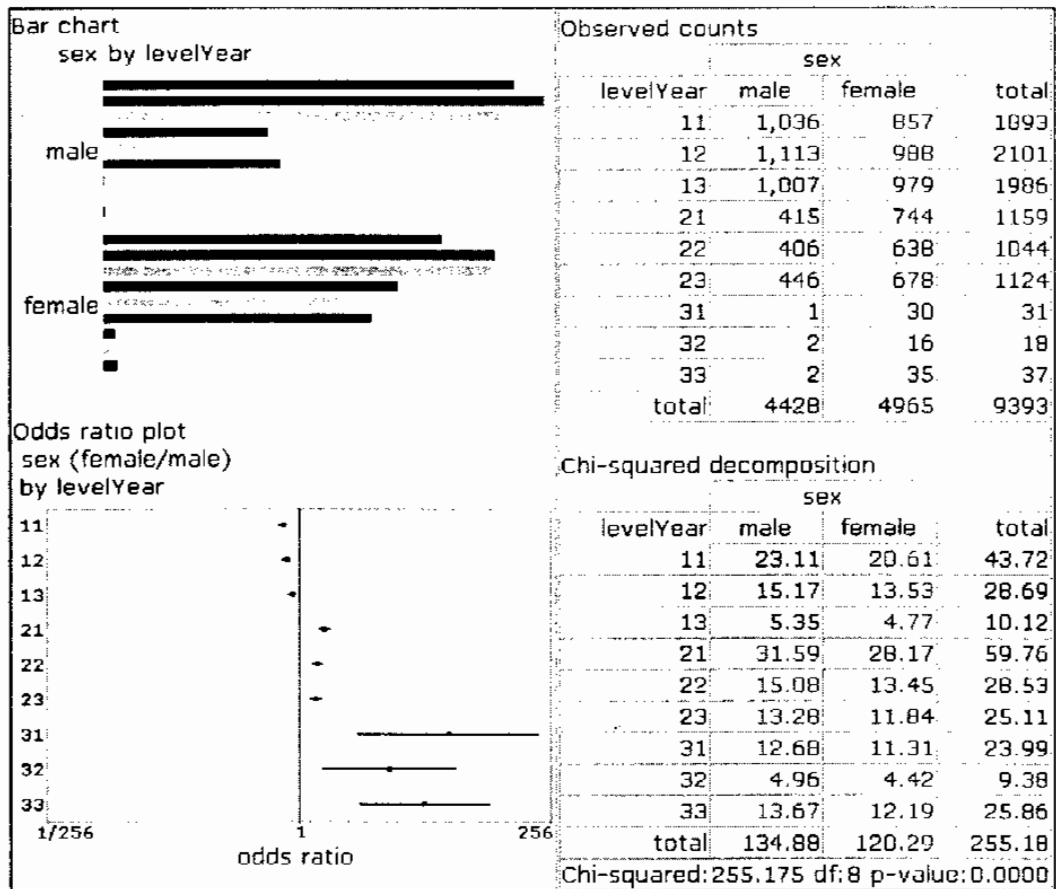


Figure 3.6: Association between sex and level/year

Figure 3.7 shows the association between sex and birth place. Sabarang is the only place that has more females at Pattani public high schools, while Anarhu, Kapor, Maelan and the Bangkok area has more males.

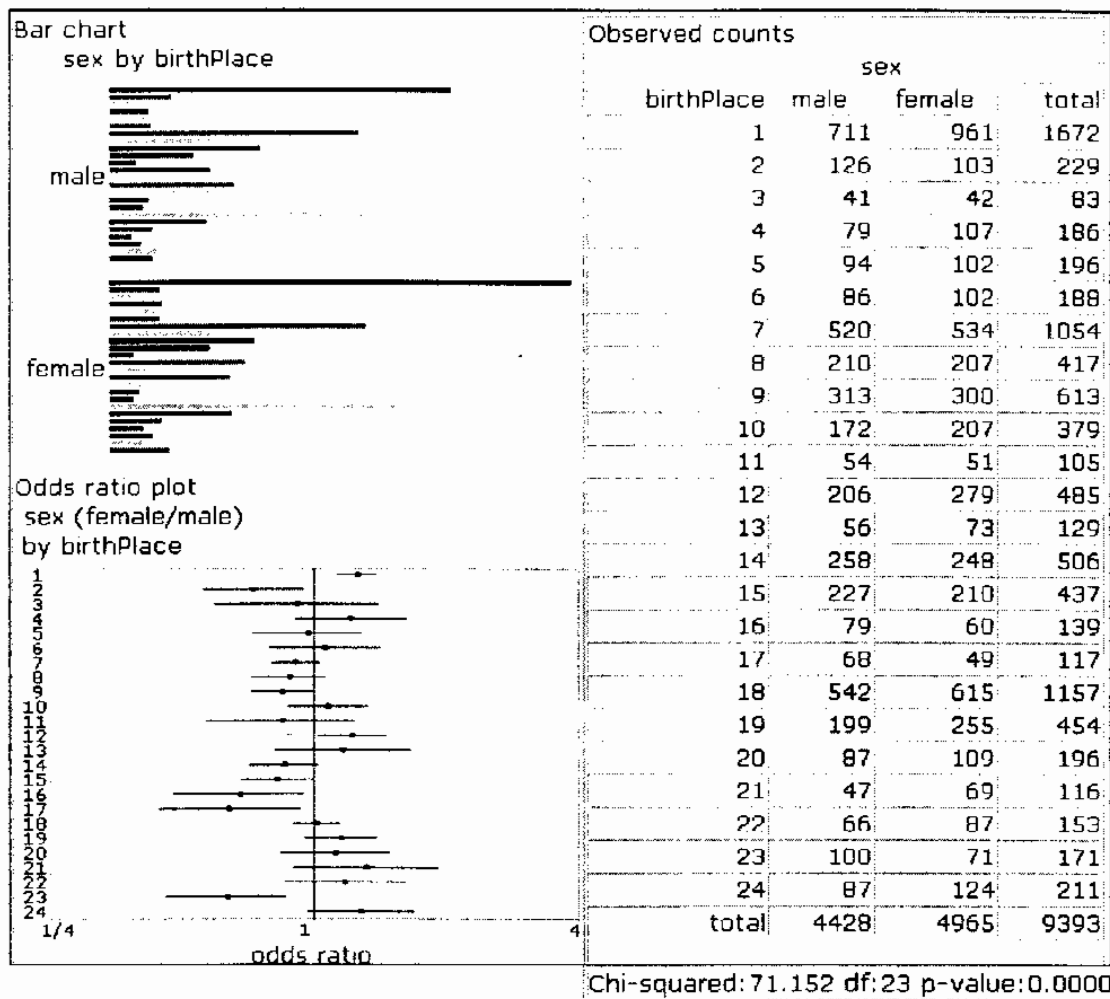


Figure 3.7: Association between sex and birth place

Figure 3.8 shows the association between religion group and age group. It shows that the proportion of Muslim students increases steadily with age, from 31.5% among the 12-13 year olds to 56.3% among students aged 18 or more.

Figure 3.9 shows the association between religion group and level/year. It shows a contrast between Mattayom1-4, and vocation3 (where the proportion of Muslim students is relatively low) and Mattayom5 (where the proportion of Muslim students is relatively high).

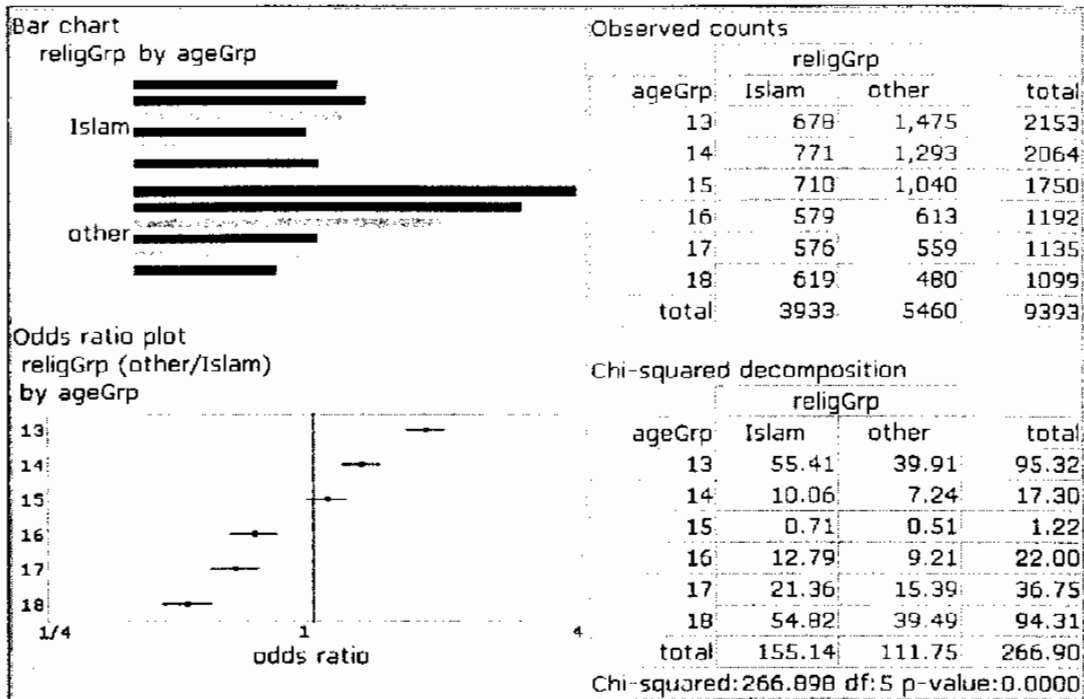


Figure 3.8: Association between religion group and age group

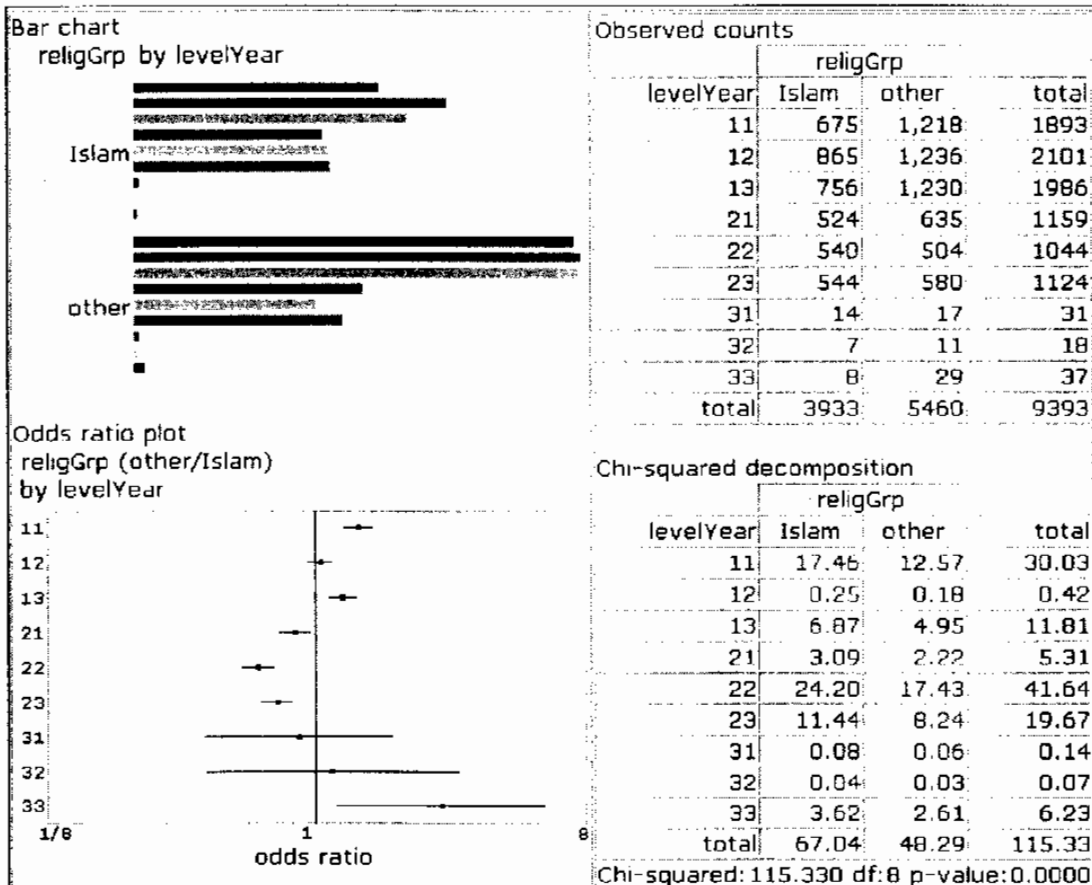


Figure 3.9: Association between religion group and level/year

Figure 3.10 shows the association between religion group and birth place. It shows that the proportion of Muslim students at public high schools in Pattani varies substantially, with high proportions in JabanTiko, combined other Pattani city subdistricts, and Nongjik, Mayor, Tungyungdang, Yaring, Yarang and Kapor districts. In contrast, Sabarang, Bana, and Rusamilac subdistricts, Khopho and Maelan districts, Yala, Songkla, NakornSiThammarat and other southern provinces, and Bangkok and all other places combined have relatively low proportions of Muslim students.

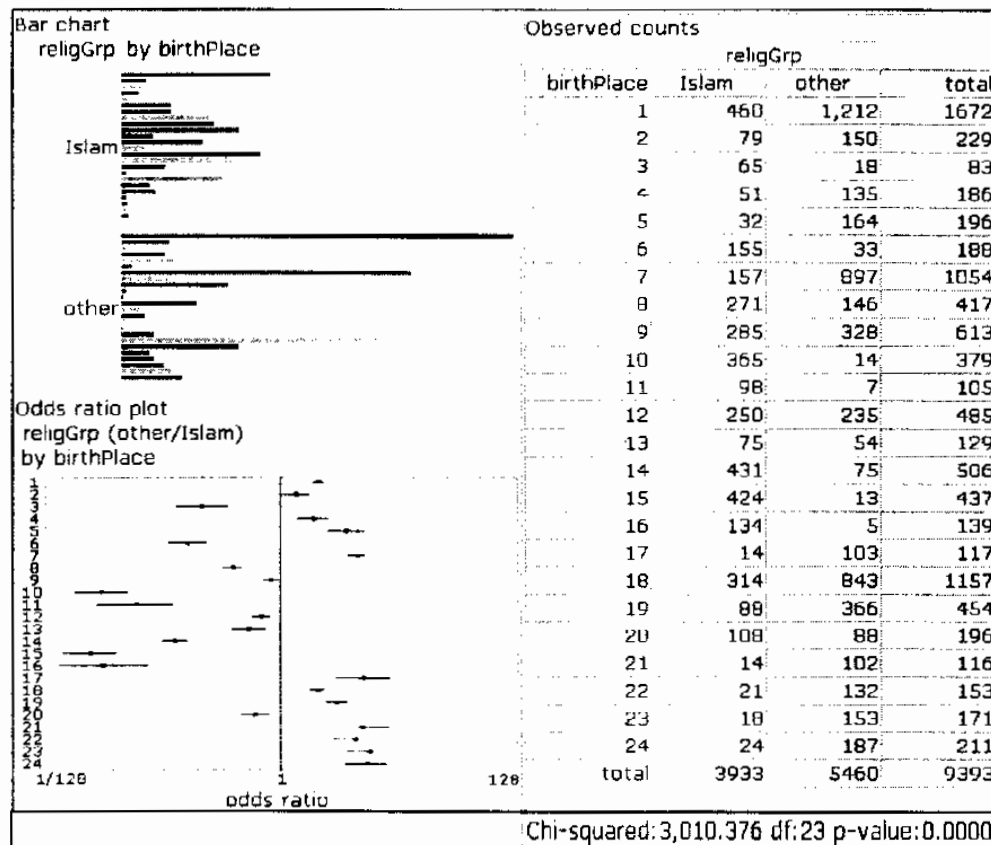


Figure 3.10: Association between religion group and birth place

Figure 3.11 shows the cross tabulation of age group and level/year. As expected, there is a high correlation between these two determinants.

Figure 3.12 shows the comparison of combined parents' salary, expressed using a log transformation, with respect to religion group. The upper panel shows the results for all

students, and the lower panel shows the same comparison after omitting the 925 students whose parental salaries were coded as 0s.

Observed counts							
levelYear	ageGrp						total
	13	14	15	16	17	18	
11	1,638	148	51	8	15	33	1893
12	485	1,361	171	51	22	11	2101
13	22	530	1,191	169	51	23	1986
21	6	17	321	666	104	45	1159
22	0	7	9	271	622	135	1044
23	0	0	3	10	296	815	1124
31	2	1	4	14	8	2	31
32	0	0	0	3	12	3	18
33	0	0	0	0	5	32	37
total	2153	2064	1750	1192	1135	1099	9393

Figure 3.11: Association between age group and level/year

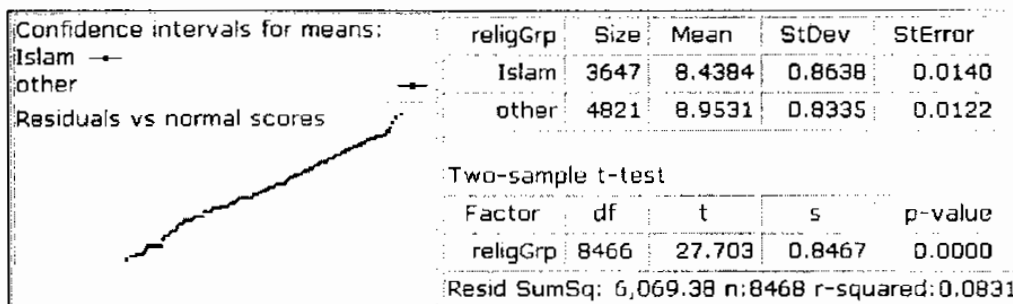
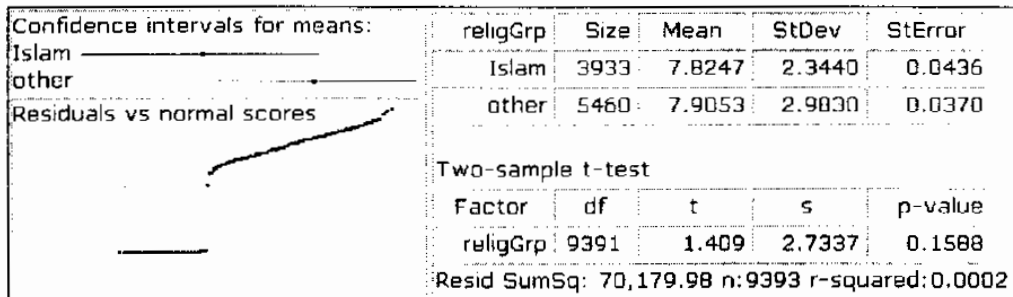


Figure 3.12: Comparison of parents' combined salary by religion group

There is no association when the students with 0-coded parent's combined salaries are included, but there is a difference when they are excluded, with Muslim students' parents earning substantially less than others.

Since there is no valid reason to assume that 0-coded salaries are 0, or even less than reported salaries, in further statistical analysis these salaries are taken as missing values.

Figure 3.13 shows the comparison of parents' combined salary with respect to sex, omitting the 925 cases with salaries coded as 0. Sex is not difference evidence.

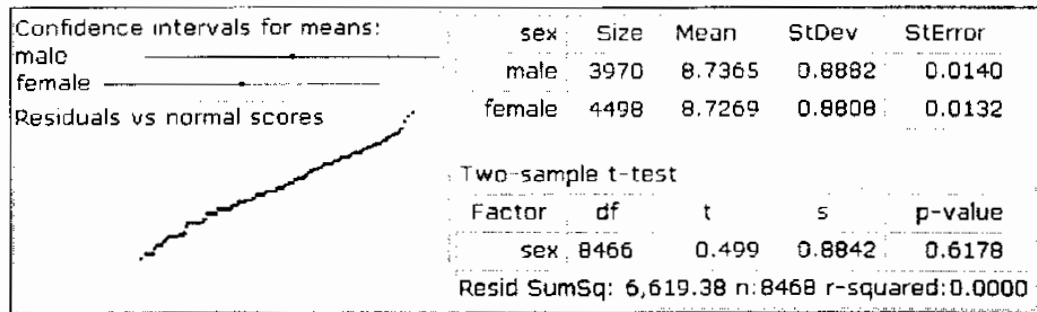


Figure 3.13: Comparison of parents' combined salary by sex of student with 0s omitted

Figure 3.14 shows that there is no evidence that parents' combined salary is related to age group.

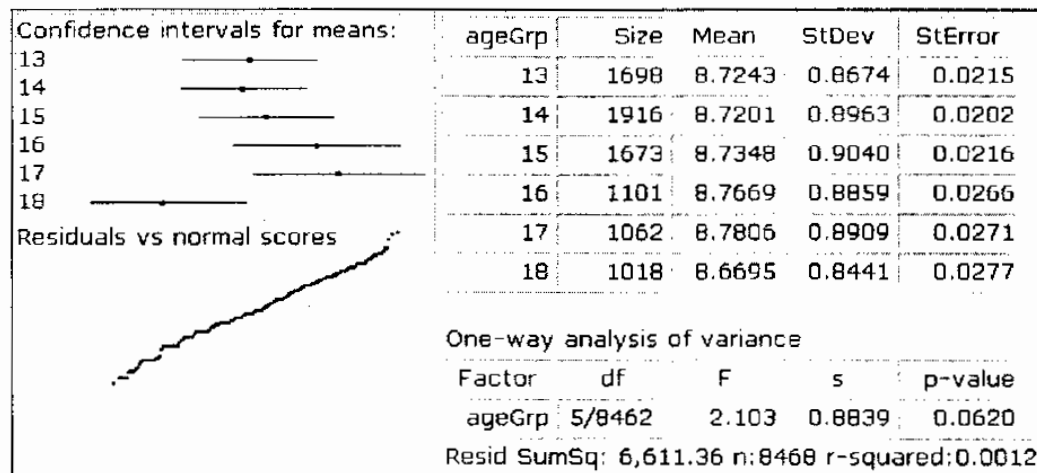


Figure 3.14: Comparison of parents' combined salary by age group with 0s omitted

Figure 3.15 shows the same comparison with respect to level/year. In this case there is an effect. The parents' combined salaries are higher for students in Level 2 (Mattayom4-6).

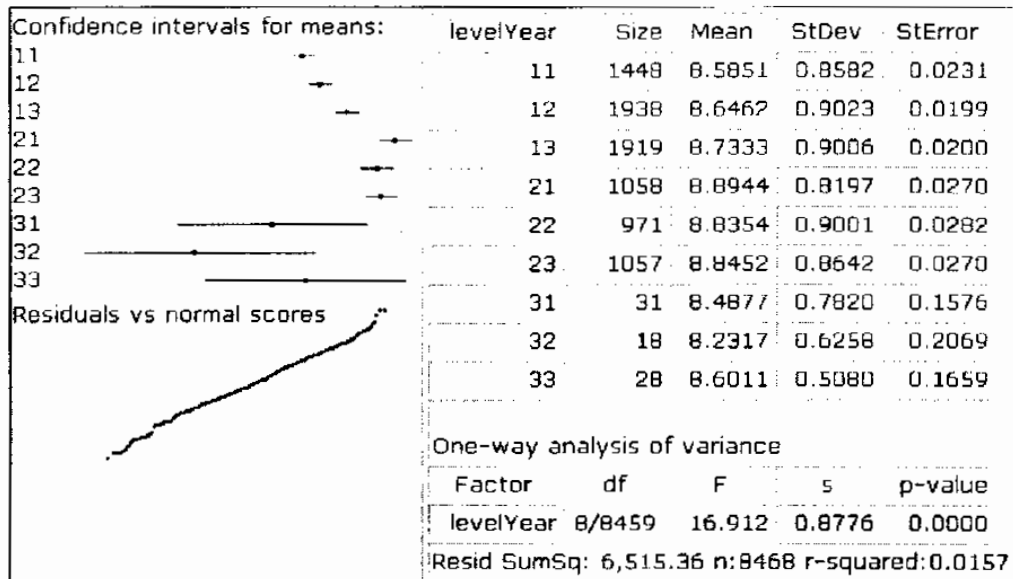


Figure 3.15: Comparison of parents' combined salary by level/year with 0s omitted

Figure 3.16 shows the same comparison with respect to birth place. There are three groups of parent's salary, the lower parent's salary is Kapor district, the middle group comprises Nongjik, Panare, Mayor, Tungyangdang, Maikan, Yaring and Yarang districts, and the high group comprises all subdistricts of Pattani city, Khokpho and Saiburi districts and another province of Thailand.

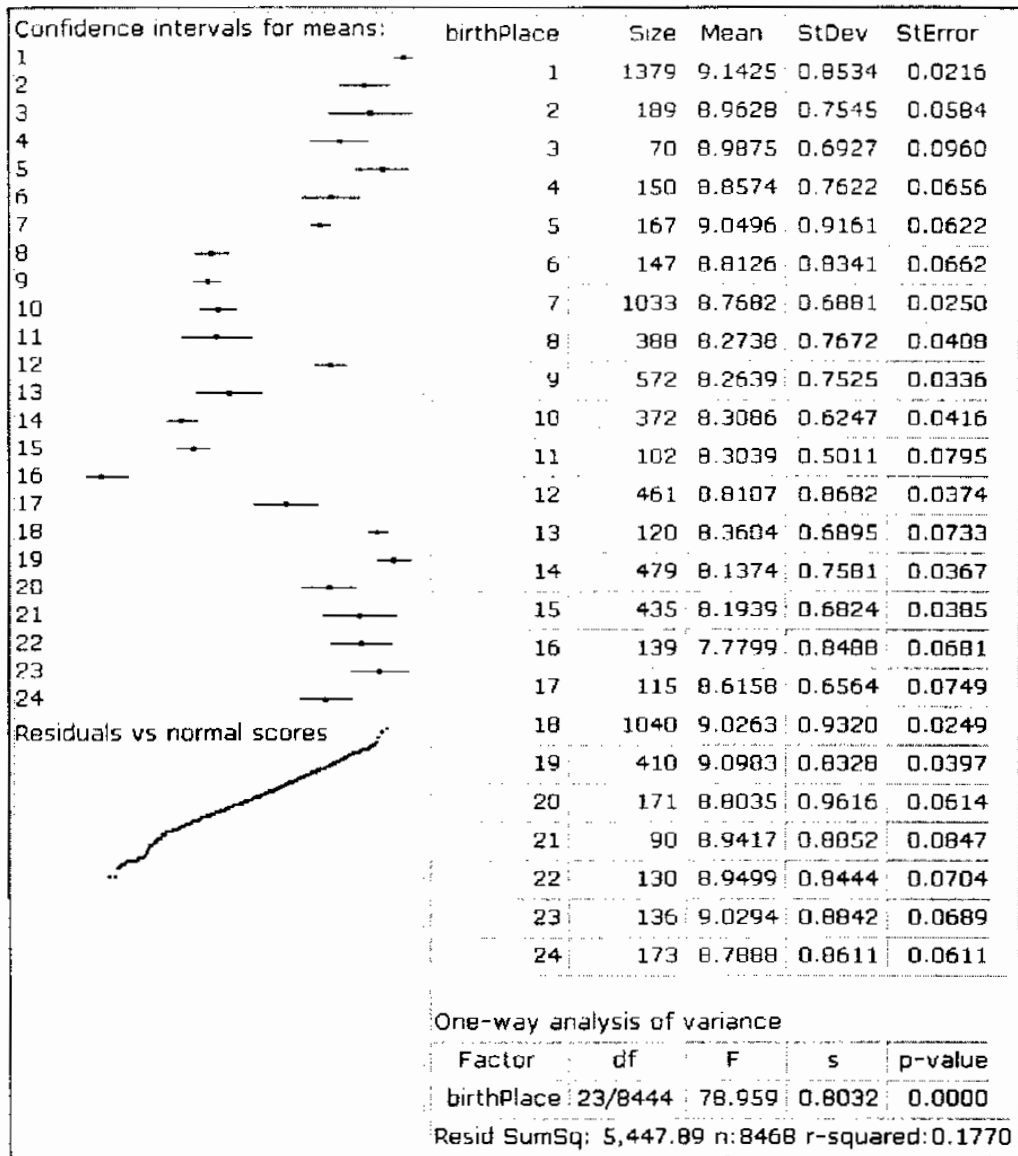


Figure 3.16: Comparison of parents' combined salary by birth place with 0s omitted

3.5 Associations between Outcome and Determinants

In this section we examine the associations between outcome and determinants.

Figure 3.17 shows the association between $\ln(\text{BMI}-8)$ and sex. It shows that the BMIs of the females are higher.

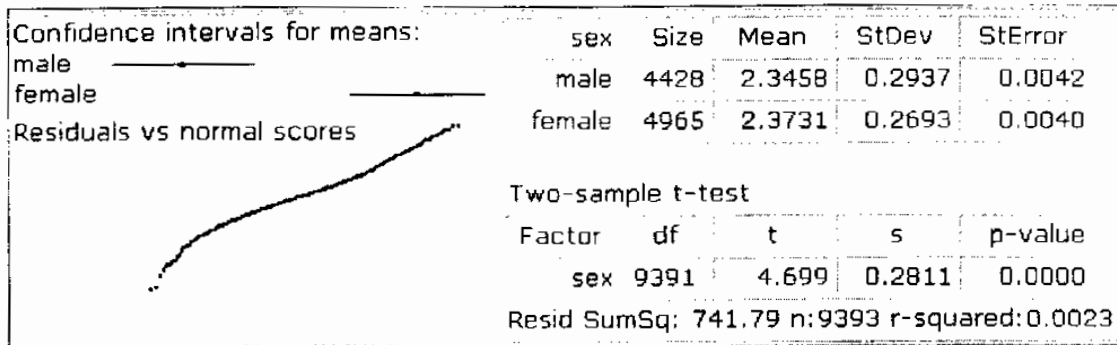


Figure 3.17: Association between ln(BMI-8) and sex

Figure 3.18 shows the association between ln(BMI-8) and age group. As the students grew up their BMIs increased.

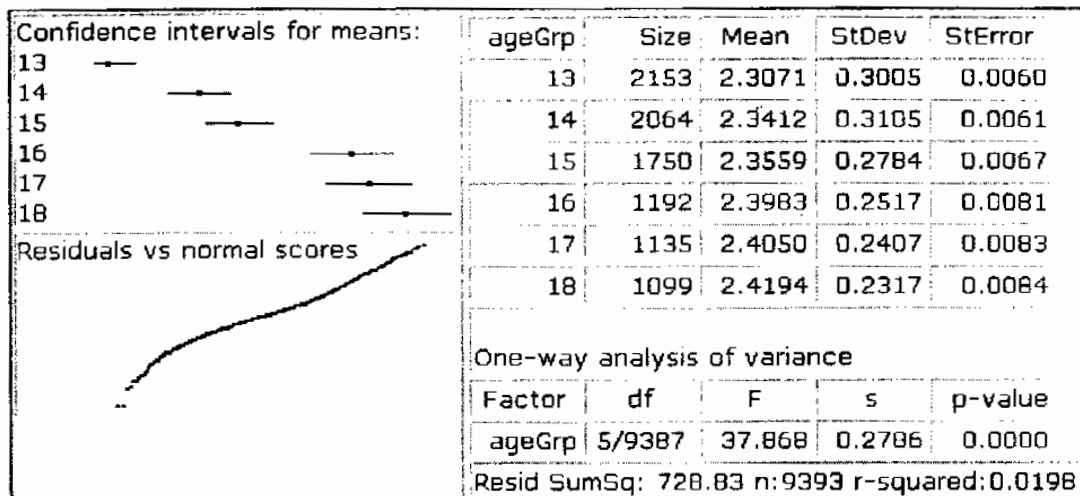


Figure 3.18: Association between ln(BMI-8) and age group

Figure 3.19 shows the association between ln(BMI-8) and religion group. Muslim students had lower BMIs than others.

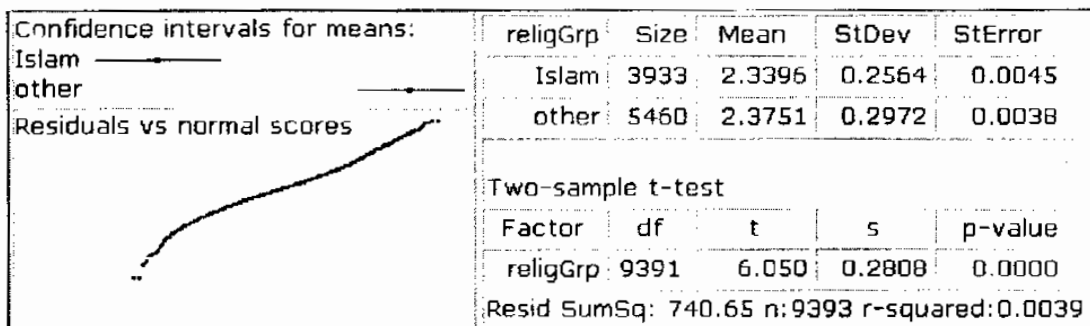


Figure 3.19: Association between ln(BMI-8) and religion group

Figure 3.20 shows the association between $\ln(\text{BMI}-8)$ and level/year. The BMIs increased with level/year with the exception for Vocation1-3, where the confidence intervals are wide because of small number of the students in vocation level.

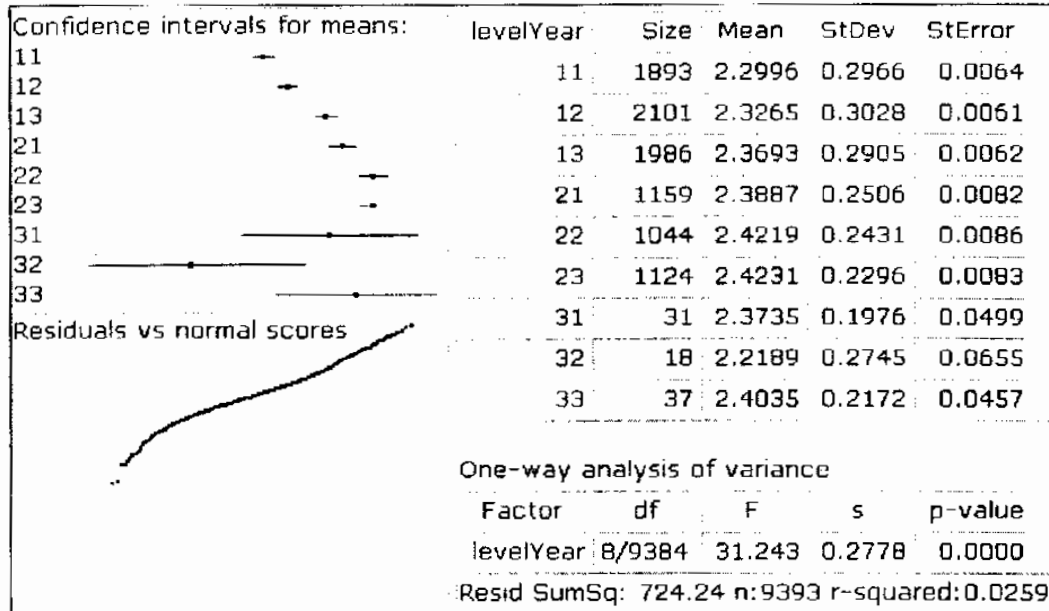


Figure 3.20: Association between $\ln(\text{BMI}-8)$ and level/year

Figure 3.21 shows the association between $\ln(\text{BMI}-8)$ and birth place. The students from Maikan district had lower BMIs.

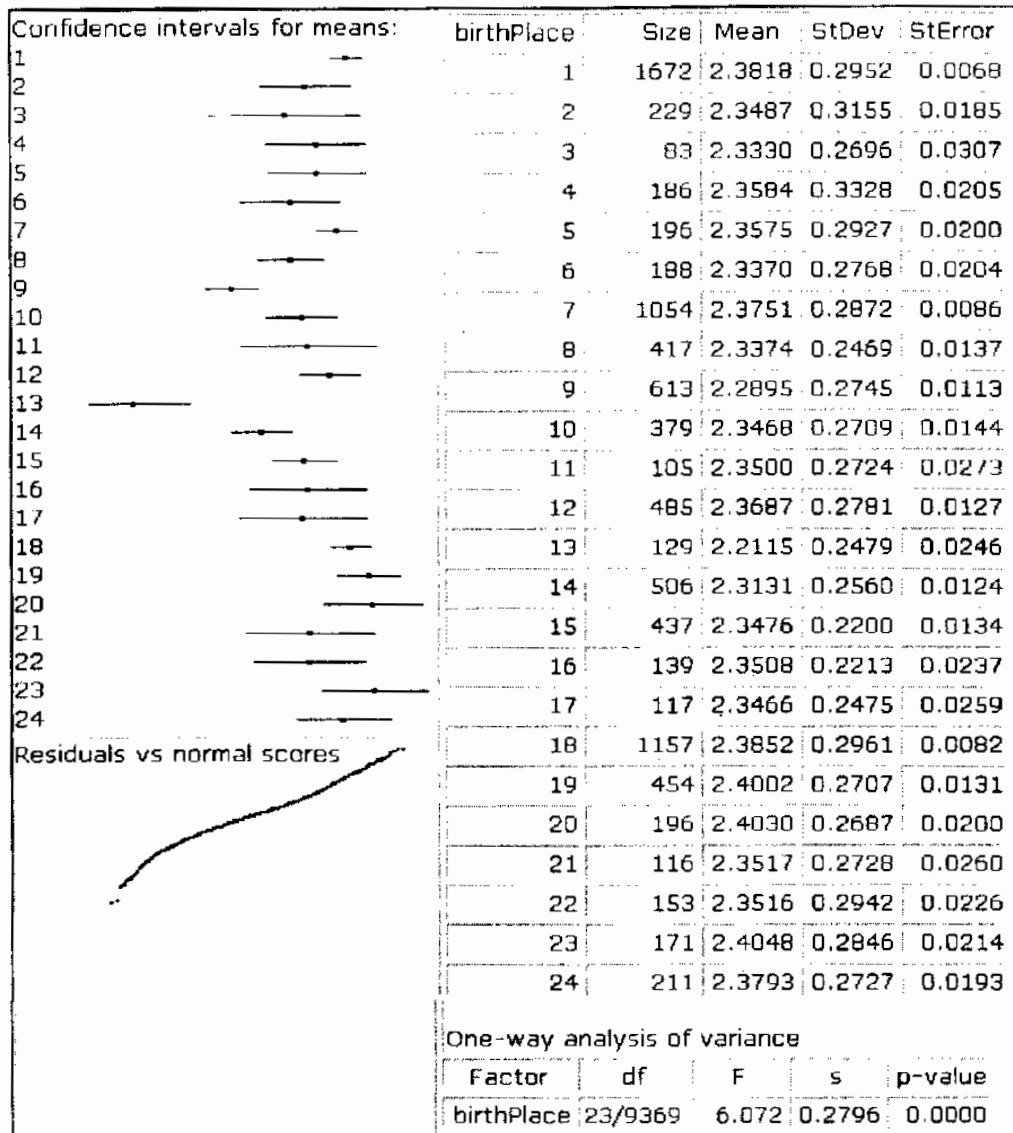


Figure 3.21: Association between ln(BMI-8) and birth place

Figure 3.22 shows the association between ln(BMI-8) and parent's salary. The students with parent's high salary had higher BMIs.

Linear Regression Analysis: Outcome = lnBMIminus8				
Determinant	Coefficient	StError	95% CI	p-value
Constant	2.0686	0.0301	2.0097, 2.1276	0.0000
lnParentSalary1	0.0336	0.0034	0.0268, 0.0403	0.0000

r-sq: 0.0112 df: 8466 RSS: 658.1815 s: 0.2788

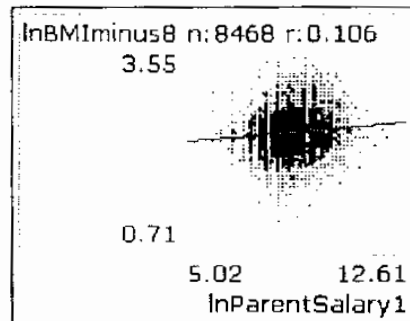


Figure 3.22: Association between ln(BMI-8) and parent's salary with 0s omitted

It was of interest to compare BMI after taking age, sex and religion into account. Figure 3.23 shows the mean BMI after this adjustment. The BMI is different among the four groups with higher BMI for non-Muslim students. Non-Muslim females had higher BMIs than their male counterparts at ages 14, 15 and 18. For Muslim group, females had higher BMI for all ages, with the exception to age 13. The age patterns of BMI differ for the four groups. The non-Muslim students have higher BMI than Muslim students for both sexes and every age group. The Muslim females show a steady increase in average BMI from 18.1 at age group 12-13 to 19.4 at age 17 and then remain constant. The pattern for non-Muslim males is similar, but less steady. In contrast, the average BMI for Muslim males does not begin to increase until 15, and then increases rapidly from age 15 to 16, whereas the non-Muslim females increase their BMI rapidly between ages 12-13 and 14 and then slow down.

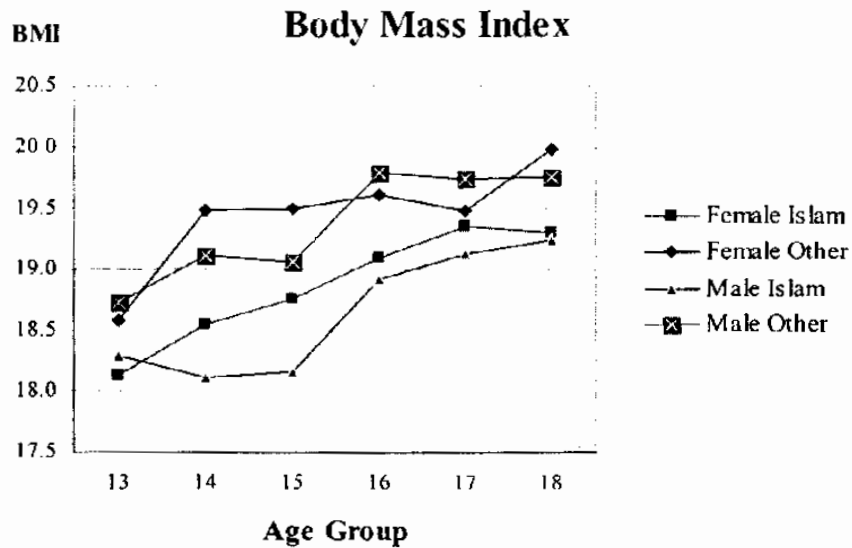


Figure 3.23: Age patterns of body mass index

Next, we examined mean BMI for each birth place.

Figure 3.24 shows a schematic range map of mean BMI of all students in the various birth places in Pattani province calculated directly from the data. We see that the students who were born in 11 subdistricts of Saiburi district, 12 subdistricts of Khokpho district, Sabarang and Bana subdistricts have high BMI between 19.09 and 19.67. The low BMI, between 17.42 and 18.46, is located in 10 subdistricts of Panare district, 18 subdistricts of Yaring district, and 4 subdistricts of Maikan district.

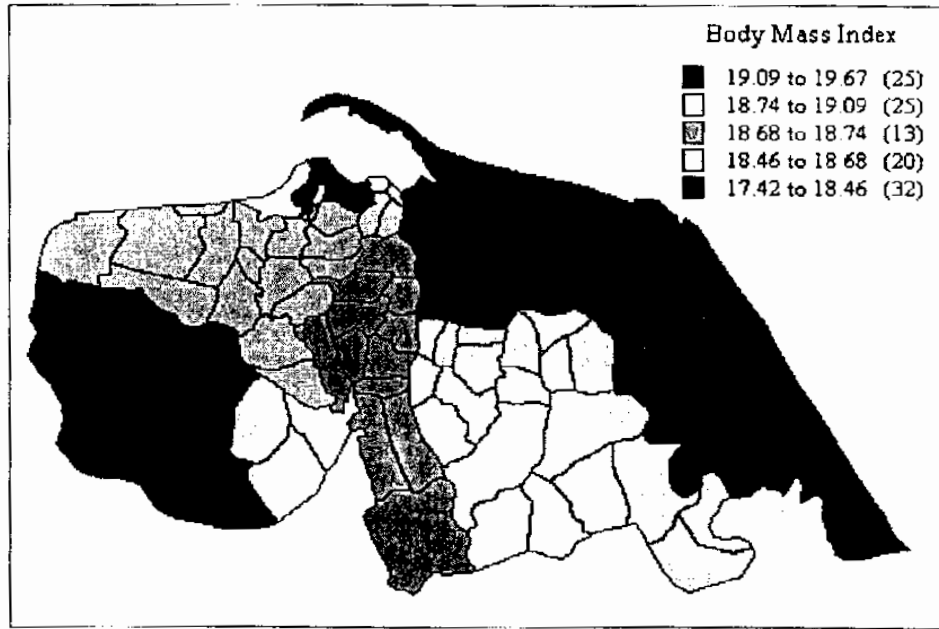


Figure 3.24: BMI map for public high school students in Pattani province