A Comparison of the Results from Somatotype Evaluation with Different Evaluation Tools

Supposing that somatotype evaluation results would have significant differences between the public group with less amounts of exercises and the special group with intensive exercises for three to four times a day, this study aimed at comparing the mutual consistency between the results determined by somatotype evaluation tools such as visually calculated index(VCI), Röhrer's Index(RI) and Body Mass Index(BMI).

The public, taekwondo players and judo players groups were composed of fifty persons, taekwondo players and judo players passed through VCI determination, respectively. Their height and weight were examined and analyzed with somatotype evaluation tools.

Comparison of somatotype dispersion of RI and VCI showed that most women were determined by VCI as lean type but were determined by RI as normal type. And that women were determined by VCI as fat type but were determined by RI as normal type. Therefore both men and women showed significant differences in VCI and RI.

Comparison of somatotype dispersion of VCI and BMI showed that both men and women were overestimated or underestimated by VCI rather than by BMI.

Comparison of somatotype dispersion of RI and BMI showed that men were less determined by BMI as lean type compared with women; both men and women less determined by BMI rather than by RI as normal type; and both men and women, in particular, were more determined by BMI as fat type but men were more determined by BMI rather than by RI as fat type.

Total somatotype consistency by tools showed that VCI has the greatest possibility of determining the public group, compared with other groups as lean type and that the consistency of the three tools were relatively higher for the taekwondo players and judo players groups, compared with the public.

Key words : *Body Mass Index(BMI), Röhrer's Index(RI), Somatotype, Visually Calculated Index(VCI)*

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INTRODUCTION

Somatotype is formed the psychological impactions of the conflict such as sex distinction, birth position, and the parent's genetic factors and climate, culture, lifestyle, nutrition, physical activity, socioeconomic status, environmental factors(1, 2).

Because of the most somatotype judgment criteria is studied for european, so when these methods are chosen, it must be reviewed whether it is methods to deserve to be character of bodies in the difference, eating habits of somatotype of an Oriental and a Westerner(3).

According to Gibson(4), physical index is faulty in distinguishing actual body fat, muscle mass, and edema in that it is calculated only by height and weight and those who are heavier than mean weight with more muscle mass and less body fat such as athletes are diagnosed to be obese. In general, a method of diagnosing physical figures by applying the

values of physical measurements for Röhrer's Index, BMI, and Vervaeck Index, or a method of diagnosing physical figures by using of body fat percentage is used for diagnosing obesity.

As for the standard to appear, represents the relationship between weight and height Röhrer's Index $[(weight(kg)/height(cm)^3 \times 10^7, 1908)]$ is the most widely used.

BMI $[weight(kg)/height(m)^2]$ is used to measure the amount of fat by using the men's height and weight(5). In addition, "Obesity Task Force" stated that a BMI of adults and children obesity was measured as the sensible tool(6, 7, 8, 9).

Therefore, this study is comparing the mutual consistency among the results determined by somatotype evaluation tools, such as visually calculated index, Röhrer's index and BMI.

MATERIALS AND METHODS

Subjects

The subjects of this study were healthy students of Yongin University who are 20 to 25 years old as of October of 2004 and had no pathologically abnormal findings in the nervous and musculoskeletal systems. A total ten same estimators(five males and five females) diagnosed them based on the standard for physical figure, and submitted the names and physical figures of the subjects. The physical figure decided by majority was estimated to be the type of each subject. When a subject was correspondent in the rate of estimation of vision index, he or she was excluded from this study (e.g. thin type : normal type : obese type = 4 : 4 : 2)

This study was composed of fifty persons who passed VCI determination respectively in which the non-athlete group, taekwondo players group and judo players group.

A standard on the somatotype of each index

Visually calculated index
A standard of visually calculated index is as followed.

* Lean type : low weight and thin somatotype.
* Normal type : Enough or well-developed muscles somatotype.
* Fat type : Puffy face and limbs and paunchy somatotype.

Röhrer's Index
Somatotype is classified that above 160 is fat type and normal type is 111~159, and below 110 is lean type in Röhrer's Index

$$Röhrer's\ Index = weight(kg)/height(cm)^3 \times 10^7$$

Body Mass Index
The subjects were divided into lean type, normal type and fat type in which refer to the Korean Society for the Study of Obesity 'Obesity Criteria of Koreans Table '

Table 1. Transformation of the Body mass index (BMI)

Obesity criteria of Koreans		
Classification	BMI(kg/m^2)	Somatotype
Low weight	<18.5	Lean type
Normal weight	18.5~22.9	Normal type
Over weight	≥23.0	
Danger weight	23.0~24.9	
Obesity 1 phase	25.0~29.9	Fat type
Obesity 2 phase	≥30	

Statistical analysis

Data were analyzed as followed with SPSS 11/PC. First, the study was executed the frequency and percentage analysis using technical descriptive statistics to determine the distribution of the sex. Second, one-way ANOVA was executed between somatotypes of the each groups to determine significant difference. $p < 0.05$ was considered statistically significant. If there was ANOVA results difference, Duncan's Test of multiple comparison was carried out.

RESULTS

Non-athlete group

As a result of having measured in VCI, frequency of lean type and fat type appeared highly. And as a result of having measured in RI and BMI, frequency of normal type appeared highly.

In the relationship between RI and BMI, the relatively high for matching. But BMI index was relatively more likely to fat type measure than RI. BMI index is relatively higher than the RI that measured possibility the fat type or lean type⟨Table2⟩⟨Fig1⟩.

Taekwondo players group

Taekwondo players group was relatively small fat type compared to the other group's.

Determined by VCI, Taekwondo players group was relatively high frequency of normal type compared to the non-athlete group. However, in the case of lean type was measured the normal type by the RI and the BMI.

In the relationship between RI and BMI, the matching was the relatively higher than the non-athlete group. But it was tendency to highly measured the normal type by RI And BMI index is relatively more higher to fat type higher than the RI〈Table3〉〈Fig2〉.

Judo players groups

Determined by BMI, judo players group was relatively high frequency of fat type and relatively low frequency of lean type compared to the other group's. Even if it was determined lean type by VCI, it was showed normal type by the RI and BMI〈Table4〉〈Fig3〉.

Table 2. Somatotype consistency by tools showed of non-athlete group

(Unit : person)

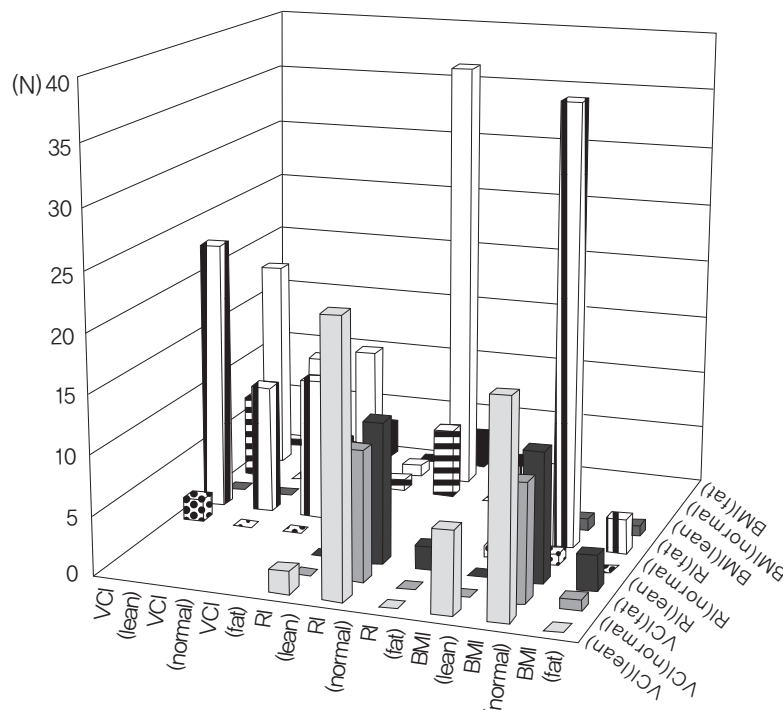| Classification		N	Somatotype by tools showed								
			VCI			RI			BMI		
			Lean type	Normal type	Fat type	Lean type	Normal type	Fat type	Lean type	Normal type	Fat type
VCI	Lean type	25				2	23	0	7	18	0
	Normal type	11				0	11	0	0	10	1
	Fat type	14				0	12	2	0	11	3
RI	Lean type	2	2	0	0				1	1	0
	Normal type	46	23	11	12				6	37	3
	Fat type	2	0	0	2				0	1	1
BMI	Lean type	7	7	0	0	1	6	0			
	Normal type	39	18	10	11	1	37	1			
	Fat type	4	0	1	3	0	3	1			

Fig. 1. Somatotype consistency by tools showed of non-athlete group

Table 3. Somatotype consistency by tools showed of Taekwondo players group

(Unit : person)

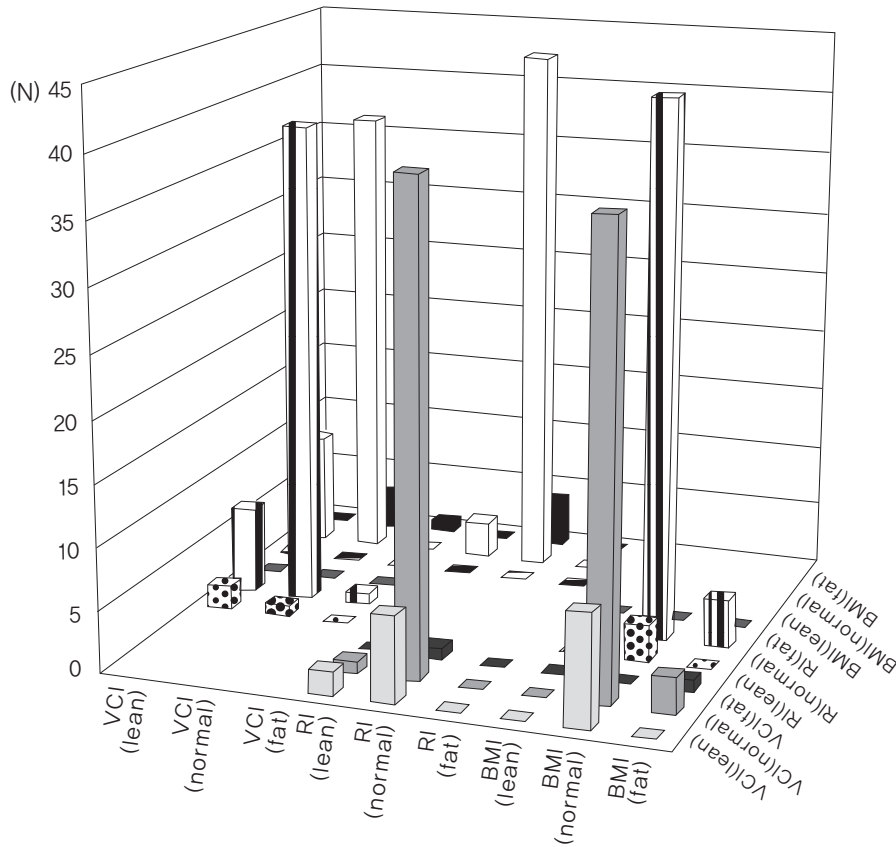| Classification		N	Somatotype by tools showed								
			VCI			RI			BMI		
			Lean type	Normal type	Fat type	Lean type	Normal type	Fat type	Lean type	Normal type	Fat type
VCI	Lean type	9				2	7	0	0	9	0
	Normal type	40				1	39	0	0	37	3
	Fat type	1				0	1	0	0	0	1
RI	Lean type	3	2	1	0				0	3	0
	Normal type	47	7	39	1				0	43	4
	Fat type	0	0	0	0				0	0	0
BMI	Lean type	0	0	0	0	0	0	0			
	Normal type	46	9	37	0	3	43	0			
	Fat type	4	0	3	1	0	4	0			

Fig. 2. Somatotype consistency by tools showed of Taekwondo players group

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Table 4. Somatotype consistency by tools showed of Judo players group

(Unit : person)

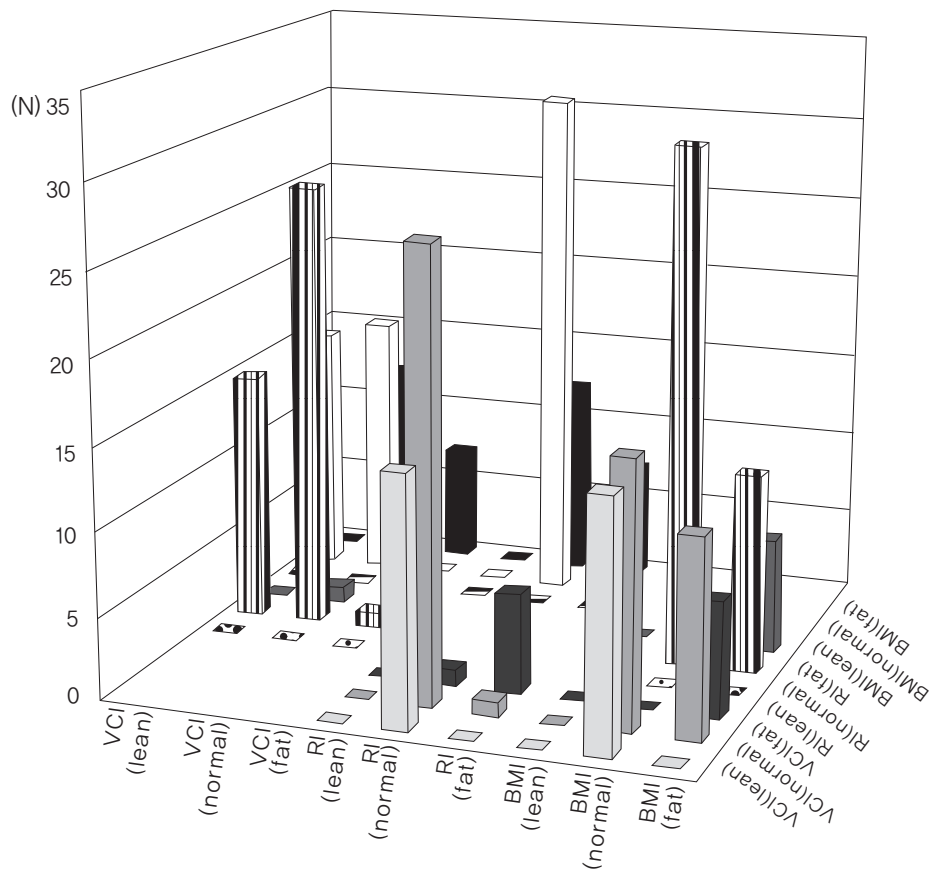| Classification		N	Somatotype by tools showed								
			VCI			RI			BMI		
			Lean type	Normal type	Fat type	Lean type	Normal type	Fat type	Lean type	Normal type	Fat type
VCI	Lean type	15				0	15	0	0	15	0
	Normal type	28				0	27	1	0	16	12
	Fat type	7				0	1	6	0	0	7
RI	Lean type	0	0	0	0				0	0	0
	Normal type	43	15	27	1				0	31	12
	Fat type	7	0	1	6				0	0	7
BMI	Lean type	0	0	0	0	0	0	0			
	Normal type	31	15	16	0	0	31	0			
	Fat type	19	0	12	7	0	12	7			

Fig. 3. Somatotype consistency by tools showed of Judo players group

Table 5. Somatotype consistency by tools showed of all groups

(Unit : person)

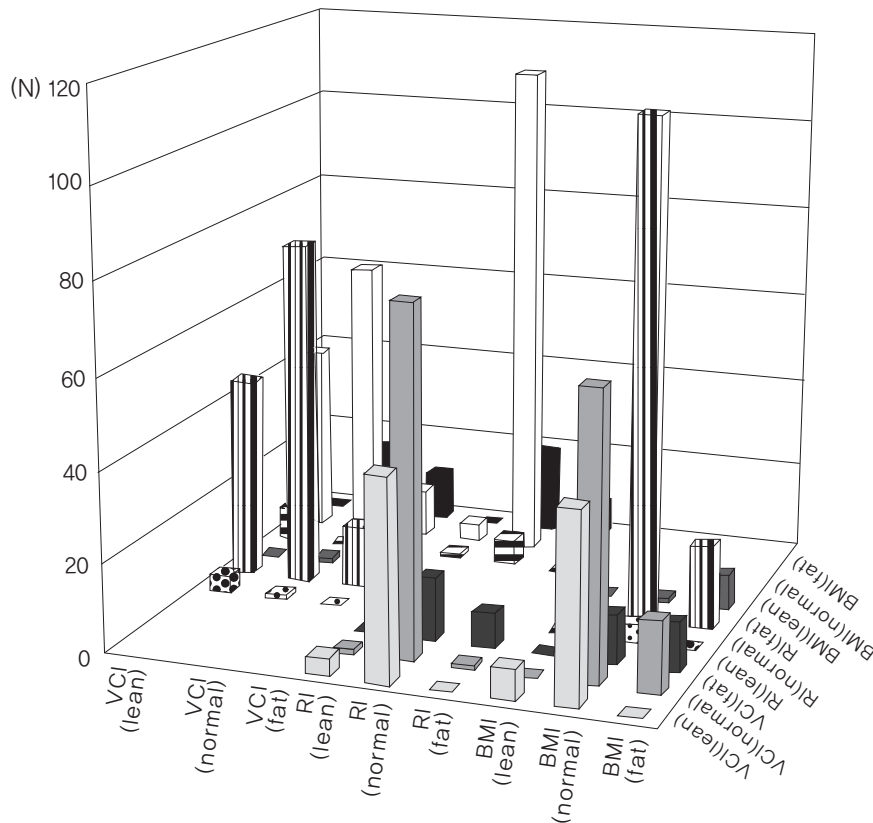| Classification		N	Somatotype by tools showed								
			VCI			RI			BMI		
			Lean type	Normal type	Fat type	Lean type	Normal type	Fat type	Lean type	Normal type	Fat type
VCI	Lean type	49				4	45	0	7	42	0
	Normal type	79				1	77	1	0	63	16
	Fat type	22				0	14	8	0	11	11
RI	Lean type	5	4	1	0				1	4	0
	Normal type	136	45	77	14				6	111	19
	Fat type	9	0	1	8				0	1	8
BMI	Lean type	7	7	0	0	1	6	0			
	Normal type	116	42	63	11	4	111	1			
	Fat type	27	0	16	11	0	19	8			

Fig. 4. Somatotype consistency by tools showed of all groups

Total groups

When one is diagnosed as thin body type and obese type in vision index, his or her Röhrer's index and BMI are diagnosed as normal type with considerably high frequency. Vision index may have higher probability in erring because it is for diagnosing only external features. Vision index is not objectified one, and in relatively many cases underestimation and overestimation may be performed based on the subjects and their sex.

As for correspondence between Röhrer's index and BMI, although Röhrer's index has more possible than BMI in diagnosing as normal type and BMI has relatively more possible than Röhrer's index in diagnosing as obese type, it is sufficiently probable in diagnosing to be the same type. Therefore, Röhrer's index and BMI may be similar to each other in several aspects〈Table5〉〈Fig4〉.

DISCUSSION

According to Lee et al.(3), when a method with which BMI, Broca, and Röhrer's indexes among physical figure classifications were selected and the scopes of physical figure levels diagnosed by each physical index could be expressed on a chart of height and weight was developed and degrees of correspondence among the physical indexes by comparing the scopes of physical figure levels, weight affected the diagno-sis of physical figure levels more than height by BMI, Broca, and Röhrer's indexes (orderly), and among the diagnoses of physical figure levels were not corre-sponded among the methods at a considerable degree.

According to Shin et al.(10), when obesity tendency of elementary school students shown by physique indexes (BMI and Röhrer's index) and body fat percentage was identified, the rate of obesity distribution by BMI was higher than that by body fat percentage and thus tended to be overestimated, while the rate by body fat percentage tended to be underestimated.

As a result of studies of Lee et al.(3) and Shin et al.(10), weight is the relatively high in the judo players group compared to other groups by BMI and they are likely to be fat type that is consistent with the results of this research. In other words, the result of this research, the determination of BMI Judo players group is the relatively high frequency of the fat type and low frequency of the lean type than non-athlete group and Taekwondo players group. These results is estimated that the weight reflects the value of BMI in the judo players group.

As a result of Sung et al.(11) studies about correlation among body index, body fat and body measurement index with the female college students, BMI index is the most useful in measurement of obesity.

In the evaluation of perception and satisfaction, the subjects diagnosed themselves to be exceedingly obese because they perceived themselves to be bigger than objective results. Therefore, it was reported that the subjects visually estimated their own bodies without scientific base.

The results of Sung et al.(11) reporting that body weight is closely correlated to obesity and that visual estimation is insufficient in objectivity are correspondent to those of this study. The group of Taekwondo athletes had relatively small percentage in obese type maybe because Taekwondo is characteristic in speed of the whole body and then most of the athletes had lower weight.

In the estimation of overall correspondence by tools of physical figure evaluation used in this study, the possibility of diagnosing to be thin type was relatively higher in visual index than in Röhrer's index or BMI, or in normal group rather than other groups. Also, some differences were shown in the results of diagnoses between Röhrer's index and BMI based on properties of sports, but groups of Taekwondo and Judo athletes showed relatively higher in correspondence of the results of visual index, Röhrer's index, and BMI. These results show that visual index, Röhrer's index, and BMI have higher correspondence as tools for evaluating physical figures of athletes and can be utilized together in physical figure evaluation.

According to Ministry of Commerce, Industry and Energy & Korean Agency for Technology and Standards(12) survey of 21,000 adults and the age of 0 to 90 years old during 2 years, Korean type is change gradually to European type in the past 25 years. It is reported that BMI as a standard for diag-nosing obesity is proportionate to age and changes in physical figure are extreme in thirties. Based on the results, it is suggested that estimation of physical figures that is being used as important data for national industries should be performed periodically and that performance of athletes may be considerably improved when the above mentioned method is applied for athletes as data for estimation.

CONCLUSION

In this study, the author selected group of 50 non-athletes , group of 50 Taekwondo athletes, and group of 50 Judo athletes to diagnose their physical figures by using of three tools—visual index, Röhrer's index, and BMI.

1. When compared of physical figure distribution by Röhrer's and visual indexes, many females were diagnosed as thin type by visual index but were normal by Röhrer's index. The females diagnosed as obese type by visual index were diagnozed as normal by Röhrer's index.

2. According to the comparison of physical figure distribution between visual index and BMI, there are many cases in which visual index rather than BMI was underestimated or overestimated both in males and females.

3. When compared of physical figure distribution by Röhrer's index BMI, as for thin type, the frequency in BMI was lower than that of Röhrer's index in males, and vice versa in females. As for normal type, the frequency in BMI was lower than that of Röhrer's index both in males and females. As for obese type, the frequency in BMI was relatively higher than that of Röhrer's index in males.

4. When compared of correspondence of overall body types by each tool, the possibility of diagnosing non-athlete group among the three groups as thin type was higher in visual index rather than other tools. Also, the correspondence by each tool was higher in the groups of Taekwondo and Judo athletes than in the non-athlete group.

The results of this study may be utilized to be basic data to frame measures with which the results discordant among estimation tools.

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