Comparison of Dental and Alveolar Arch Widths of Patients with Class II division 1 Malocclusion and Subjects with Class I Normal Occlusion of Iraqi Sample Aged (14-24) in Hilla city

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Abstract:

The size and shape of the arches have considerable implications in orthodontics diagnosis and treatment planning, affecting the space available, dental esthetics, and stability of the dentition. From the dental cast, one can analyze tooth size and shape, alignment and rotations of the teeth, presence or absence of teeth, arch form and symmetry, and arch width and occlusal relationship. This study was performed using dental casts for upper and lower arches of a total of 38 subjects with class II, division 1 malocclusions (17 males and 21 females) and of 40 normal class I subjects (20 males and 20 females) of Iraqi adult samples aged (14-24)in Hilla city. The dental and arch width dimensions measured were intercanine, intermolar, and molar alveolar in both arches to compare the transverse dimensions of the dental and alveolar arches of class II malocclusion groups with normal class I occlusion subjects and independent-samples *t*-test was applied for comparisons of the groups. The finding from this investigated indicated that, (1) there were no significantly differences in all measurements between class I and class II overall samples (2) there were no significantly differences in all measurements between class I and class II male samples except for mandibular inter canine widths (L3-3) were significantly larger in class II than in class I male samples (3) there were no significantly differences in all measurements between class I and class II female samples except for mandibular molar alveolar widths (LA6-6) were significantly larger in class II than in class I female samples (4) most of the dental and alveolar widths measurements in overall, male and female class II samples were insignificantly slightly larger than in class I overall, male and female samples. These indicates that there were no posterior crossbite tendency in the class II groups .

الخلاصة:

إن حجم وشكل الفكيين لهما دور كبير في تشخيص وطرق العلاج في تقويم الأسنان ويؤثران على الفضاء المتوفر وجمالية الأسنان واستقرار الأسنان. ومن خلال قوالب الأسنان يمكن إن نحلل حجم وشكل السن واصطفافه ودورن الأسنان ووجود أو غياب الأسنان وشكل وتناظر الفكيين وعرض الفكيين والعلاقة الانطباقية للفكيين. هذه الدراسة تمت باستعمال قوالب الأسنان للفكيين الأعلى والأسفل لمجموع (38) شخص للصف الثاني.الصنف الأول من سوء الإطباق (17 ذكر و 21 أنثى) ومن (40) شخص للصف الأول للإطباق الطبيعي (20 ذكر و 20 أنثى) من عينات العراقيين البالغين أعمارهم (14-24) سنة في مدينة الحلة. إن أبعاد العرض للأسنان والفكيين المدروسة كانت لما بين النيبان وما بين الأضراس وما بين الحويصلي الضرسي في كلتا الفكيين لمقارنة الأبعاد المستعرضة للأسنان وحويصلي الفكي للصف الثاني من سوء

الإطباق مع الصف الأول للإطباق الطبيعي باستخدام اختيار الإرجاع المقترن المستقل للنموذجيين المتساويين بالتباين (t-test) لمقارنة المجاميع. النتائج من هذا التحري أشارت إلى انه (1) لا توجد خلافات معنوية في كل القياسات بين الصف الأول والصف الثاني للعينات العمومية. (2) لا توجد خلافات معنوية في كل القياسات بين الصف الأول والصف الثاني للذكور باستثناء عرض ما بين النيبان للفك الأسفل التي كانت معنوياً اكبر في الصف الثاني عنه في الصف الأول لعينات الذكور (3) لا توجد خلافات معنوية في كل القياسات بين الصف الأول والصف الثاني للإناث باستثناء عرض ما بين حويصلي الضرسي للفك الأسفل التي كانت معنوياً اكبر في الصف الثاني عنه في الصف الأول لعينات الإناث. (4) معظم قياسات العرض للأسنان و الحويصلي السني في عينات العموم الذكور والإناث للصف الثاني كانت قليلا اكبر ولكن غير معنوية عنه في عينات الصف الأول للعموم الذكور والإناث وهذا يمثل بأنه لا توجد أي ميول للعضة المتقاطعة خلفياً لمجاميع الصف الثاني.

Introduction

Information concerning the upper and lower arches dimensions in human populations are important to clinical orthodontic diagnosis and treatment planning (1, 2). Investigators have studied the growth of arch widths in persons with normal occlusion, arch widths in adults with normal occlusion, and compared these values with those of different malocclusion samples, however, there is considerable controversy among the results presented in the literature (3, 4, 5, 6, 7, 8, 9, 10, 11, 12 , 13, 14, 15, 16, 17, 18). The results reported by Tollaro et al (11) were from II-1 children with posterior transverse interarch discrepancy. .Bishara et al(12) compared interarch differences in intercanine and intermolar widths cross-sectionally in children and found similarity between II-1 and normal occlusions. In male patients only, longitudinal curves based on interarch differences had a greater magnitude in normal occlusions than in II-1(12) . One adult study found that normal occlusion male patients had larger arch widths than female patients for five of six arch widths, whereas II-1 male patients had larger widths than female patients for only maxillary and mandibular alveolar widths. One adult study found that normal occlusion male patients had larger arch widths than female patients for five of six arch widths, whereas II-1 male patients had larger widths than female patients for only maxillary and mandibular alveolar widths(8)**.** Uysal et al findings that the maxillary interpremolar width, maxillary canine, premolar and molar alveolar widths, and mandibular premolar and molar alveolar widths were significantly narrower in subjects with Class II division 1 malocclusion than in the normal occlusion sample, maxillary molar teeth in subjects with Class II division 1 malocclusions tend to incline to the buccal to compensate the insufficient alveolar base(4) The literature review indicates that the width of the dental arches in subjects with Class II, Division 1 malocclusions was found to be either normal or narrower than the corresponding widths of normal subjects. Such a discrepancy may be attributed to

differences in the absolute size of the dental arches in the various Class II samples compared (12). A more relevant approach is to calculate and compare the differences between the maxillary and the mandibular arch widths in subjects with Class II, Division 1 malocclusions and normal subjects (8) . Huth, et al. who studies subjects of white Americans with no history of orthodontic treatment which compare arch widths in adults with Class II division 2 (II-2), Class II division 1 (II-1), and Class I normal occlusions all groups had similar mandibular intercanine and alveolar widths. The Class II division 2 and Class II division 1 groups had similar mandibular intermolar widths, both smaller than normal occlusions. The Class II division 2 and Class II division 1 groups had similar maxillary/mandibular differences in intercanine and alveolar widths, both smaller than normal occlusions(19). Furthermore, it would be of interest to determine whether the tendency for a transverse discrepancy found in the adult Class II dentition is also expressed in the earlier stages of dental arch development. The literature review indicates that when comparing Class II and normal occlusions, gender differences appear to be important. Therefore, both gender and gender pooled comparisons were made in this study. The objectives of this study were to determined the differences between the transverse dimensions of the dental arches and alveolar widths of Class II division 1 malocclusion groups with the transverse measurements of untreated normal occlusion subjects in over all samples and with in each sex. Another objective was to develop norms for adult arch widths using data from the Class I normal subjects.

Materials and Methods

All subjects were Iraqi adult sample with no orthodontic treatment. Records for 78 subjects included plaster casts with fully erupted permanent incisors, canines, premolars, and first molars. Lateral cephalograms were available for all . A sample of 40 subjects, 20 male and 20 female, with Class I normal occlusion was selected from the Department of Orthodontics in the college of dentistry of Babylon university and specialized center of orthodontic in Hilla city. the following inclusion criteria were used to collect this sample(21, 22, 4, 19) : (1) teeth well aligned within the dental arches with less than 3 mm of crowding or spacing, (2) overjet not more than 4 mm (3) first molars bilaterally Class I in centric occlusion, (4) no teeth in crossbite, (5) normal growth and development, (6) all teeth present except third molars, (7) good facial symmetry determined clinically, (8) no significant medical history, and (9) no

history of trauma, and no previous orthodontic, prosthodontic treatment, maxillofacial or plastic surgery. A sample of 38 Class II division 1 subjects, 17 male and 21 female, was selected from the records of patients who were came to the Department of Orthodontics in the college of dentistry of Babylon university and specialized center of orthodontic in Hilla city. The following inclusion criteria were used to select this sample (21, 23, 22, 24, 25) : (1) maxillary incisors labially inclined, (2) overjet greater than 7.5 mm, and (3) first molars bilaterally full Class II in centric occlusion. (4) no significant medical history; and (5) no history of trauma, and no previous orthodontic, prosthodontic treatment, maxillofacial or plastic surgery. The minimum age of the subjects chosen for this study was based on earlier evidence reporting no significant change in first molar and canine arch widths after age 13 in girls and age 16 in boys. Six arch width measurements were taken with dial calipers on the dental casts of each subject: (12, 26, 2, 4, 19)

(1) maxillary intercanine width between the cusp tips, (U 3-3)

(2) maxillary intermolar width between the tips of the mesiobuccal cusps of the first molars (U6-6).

(3) maxillary molar alveolar width at the mucogingival junctions above the mesiobuccal cusp tips of the first molars (UA 6-6).

(4) mandibular molar alveolar width at the mucogingival junctions below the buccal grooves of the first molars (LA6-6).

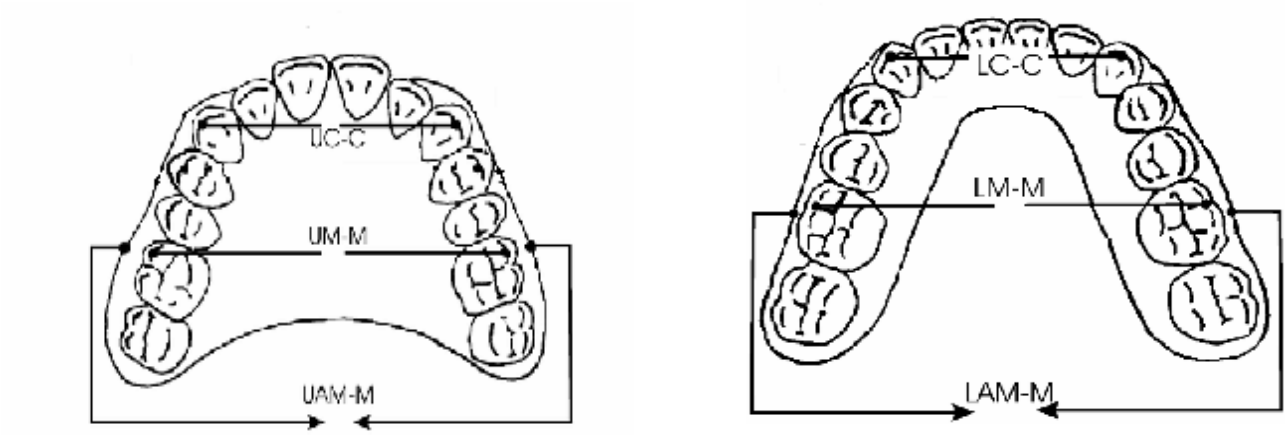
(5) mandibular intermolar width between points on the main buccal grooves located vertically at the middle of the buccal surfaces of the first molars(L 6-6).

(6) mandibular intercanine width between the cusp tips (L 3-3) (Figure 1).

Arch widths were measured with a dial calipers to the nearest 0.05 mm. Two measurements were taken at separate times for each variable measured. The intra-examiner correlations between first and second measurements for the six variables ranged from r = .95 to r = .98. The average of the first and second measurements was used for data analysis. Interexaminer correlations averaged r = .93.Computer software SPss © Vs. 12.0 (statistical package for the Social Science, Inc. 1989-2003 Copyright) was used to analyze the statistical data obtained from this study. Descriptive statistics were computed and the Independent-samples t-test was applied to compare the transverse dimensions of the dental arches and alveolar widths of Class II division 1 malocclusion groups

with the transverse measurements of untreated normal occlusion subjects in over all samples and with in each sex .

Maxilla **Mandible**



Aims of the study to determine

(1)the dental and alveolar arch widths in normal occlusion and in class II division 1 malocclusion.

(2) the differences in the dental and alveolar arch widths between:-

(a) Class I and class II division 1 malocclusion in overall samples.

(b) Class I and class II division 1 malocclusion with each sex.

Results

The sample of this study is 78 subject consisting of 40 class I mean age (21 years), 20 males the mean age (20.86 years) and 20 females the mean age (21.22 years) and 38 class II division 1 the mean age (19.3 years), 17 males the mean age (19.71 years) and 21 females the mean age (19.07 years) as demonstrated in Table (1). The descriptive statistic, including mean, standard deviations, minimum and maximum value of all variables for the total sample of class I and C1 II division 1, both the males and female group of c1ass I

and class II division 1 are present in tables (2), (3), (4).

Comparison of the dental and alveolar arch widths measurements between normal class I and class II overall samples : (Table 2)

The comparison of measurements between normal class I and class II overall samples demonstrated in table (2). All measurement were larger in class II sample than in class I sample except for upper intermolar width were larger in class I than in class II sample, however, these differences are very small in magnitude. For normal class I and class II, there were no statistically significant difference for the all measurements at P> 0.05.

Comparison of the dental and alveolar arch widths measurements between normal class I and class II male samples: (Table 3)

The comparison of measurements between normal class I and class II male samples demonstrated in table (3), indicated that there were no significant differences between them except for the lower intercanine widths (L3-3) were significantly larger in class II than in normal class I male samples at P < 0.05. All measurement were larger in class II than in class I male sample except for upper intermolar width were slightly larger in class I than in class II sample but these differences were not significant at P> 0.05.

Comparison of the dental and alveolar arch widths measurements between normal class I and class II female samples: (Table 4)

The comparison of measurements between normal class I and class II female samples demonstrated in table (4) indicated that all measurements were larger in class II than in class I females sample except for upper molar alveolar width were slightly larger in class I than in class II females sample. But these differences were not significant at P> 0.05. Except for the lower molar alveolar width (LA6-6) were significantly larger in class II than in class I female sample at P < 0.05.

Discussion

Study and determination of criterion for different ethnic groups is essential to promote accurate diagnosis and planning for orthodontic treatment. Each ethnic group has certain characteristics that should not be taken as standards for other areas with different developmental and ecological foundation **(27)**, So the differences that have been observed in this study of arch width in class I & class II with the findings of other studies may be

attributed to the following factors [Ethnic variations, sample size, method of study, age of subjects and gender dimorphism]

In spite of many studies in Iraq deal with these measurements, the present study adds new information about the dental and alveolar arch widths in class I normal occlusion and class II malocclusion. The measurements, that available in the present study are specified for age and sex for Iraqi population in Hilla city in an attempt to provide a data for orthodontic diagnosis and treatment planning.

Investigators who studied growth changes in the transverse arch width found that molar and canine arch widths did not change after age 13 in female subjects and age 16 in male subjects (2,7). The minimum ages of the subjects measured in this study were chosen on the basis of these previous studies. There fore, we assumed that the arch widths of the subjects studied were fully developed. In the normal occlusion sample only subjects with minor or no crowding were included, whereas the absence of crowding was not a criterion in the class II groups. If a class I group with crowding would be compared with a class I group without crowding, most probably narrower arches would be found in the class I group with crowding. For that reason, group differences in this study may be the result of differences concerning crowding as well and our results must be interpreted carefully.

Comparison between overall sample class I and c1ass II

Generally the comparison of measurements between overall class II and class I samples is present in table (2).

(I) Maxillary dental and alveolar arch widths :

Were no significant differences are found in maxillary intercanine widths(U3-3) between overall sample normal class I and overall sample class II at P>0.05, this finding in agreement with the finding of (4, 5, 10, 12) , but in contrasting to the finding of (8, 3) which reported that subjects with normal occlusion had larger maxillary inter canine widths than the class II malocclusion subjects.

The maxillary intermolar width (U6-6) in this present study are no significant differences between class I and class II samples at P > 0.05, this finding are similar to the finding of (5, 19) but this finding are disagree with (3, 11, 8, 10, 19) who found that the maxillary intermolar width were significantly larger in class I than in class II overall sample and also disagree with the finding of (4) who found that the maxillary intermolar width were

significantly larger in class II than in class I overall sample.

The maxillary molar alveolar width (UA6-6) in this present study were no significant differences between class I and class II overall sample at P > 0.05 on the other hand, this measurement was significantly larger in class I than in class II overall sample (19, 4).

(II) Mandibular dental and alveolar arch widths :

In this present study, there are no significant differences were found in mandibular intercanine width (L3-3) between class I and class II overall sample at P>0.05, this finding were similar to the finding of (19, 3, 5, 12, 8) but disagree with the finding of (4,10) who founds that mandibular intercanine widths were significantly larger in the class II than in class I overall sample. The mandibular intermolar width (L6-6) in this present study are no significant differences between class I and class II overall sample at P > 0.05 as similar to the finding of (5 , 11) but in contrasting to the finding of (3 , 19) who founds that the mandibular intermolar width were significantly larger in class I than in class II overall sample , and also disagree with the result of (4) who reported that intermolar width were larger in patients with class II were compared with the class I overall samples. The mandibular molar alveolar width (LA6-6) in this present study are no significant differences between class I and class II overall sample at P > 0.05, this result comes in accordance with (19) but disagree with the finding of (4) who founds that the mandibular molar alveolar widths were significantly narrower in class II than in class I overall sample.

Comparison between Class I and Class II Male samples

Generally the comparison of the measurements between class I and class II male samples is present in table (3).

(I) Maxillary dental and alveolar arch widths :

In this present study, there are no significantly differences are found in maxillary inter canine width (U3-3) between male samples of class I and class II at P > 0.05 this finding are in contracting to the finding of (19, 8, 9) which founded that subjects with normal occlusion had larger maxillary intercanine widths than class II malocclusion subjects. The maxillary intermolar width (U6-6) in this present study are no significantly differences between class I and class II male samples at P > 0.05, this finding are disagree with the finding of (19, 8, 9, 6, 7) who found that subjects with normal class I had larger maxillary intermolar widths than class II malocclusion subjects. The

maxillary molar alveolar width (UA6-6) in this present study are no significantly differences between class I and class II male samples at P > 0.05, this finding are in contrasting with the finding of (19, 8) who found that subjects with class I normal occlusion had larger maxillary molar alveolar widths (UA6-6) than class II malocclusion subjects.

(II) Mandibular dental and alveolar arch widths :

In this present study, the mandibular intercanine widths (L3-3) are found to be significantly larger in class II than in class I male samples at P > 0.05, but it differs from the findings of (19, 8) on there comparison between class I and class II male samples in which no significant difference was observed in regards to the mandibular intercanine widths (L3-3).The mandibular intermolar widths (L6-6) in this present study are no significantly differences between class I and class II male samples at P > 0.05, this finding are supported by the (9, 6, 7). But it differs from the finding of (19, 8, 6, 11) in which the mandibular intermolar width (L6-6) were significantly larger in class I than class II male samples. The mandibular molar alveolar width (LA6-6) in this present study are no significantly differences between class I and class II male samples at P > 0.05, this finding are supported by the (19) but disagree with finding of (8) who found that the mandibular molar alveolar width (LA6-6) were significantly larger in class I than class II male samples.

Comparison between class I and class II Female samples

Generally the comparison of the measurements between class I and class II female samples is present in table (4).

(I)Maxillary dental and alveolar arch widths :

In this present study, there are no significantly differences are found in maxillary inter canine width (U3-3) between female samples of class I and class II at P > 0.05. This finding are similar to the finding of (19, 10) but disagree with the finding of (8, 9) who founds that the maxillary intercanine width (U3-3) were larger in class I than in class II female samples. In this present study there are no significantly differences between class I and class II female samples in the maxillary intermolar width (U6-6) at P > 0.05. Conversely (19, 8, 10, 9, 7), stated that the maxillary intermolar width (U6-6) were larger in class I than in class II female samples. The maxillary molar alveolar widths (UA6-6) in this present study are no significantly differences between class I and class II female samples at P > 0.05, this finding are supported by (10) but disagree with

(19, 8) who staled that the maxillary molar alveolar widths (UA6-6) were larger in class I than in class II female samples.

(I)Mandibular dental and alveolar arch widths :

The mandibular intercanine width (L3-3) in this present study are no significantly differences between class I and class II female samples at $P > 0.05$. This finding are agree with the finding of (19, 8) but disagree with the finding of (10) who found that the mandibular intercanine width were larger in class II than in class I female samples. The mandibular intermolar width (L6-6) in this present study are no significantly differences between class I and class II female samples at $P > 0.05$. This finding are supported by finding of (8, 10, 7) but this finding in contracting with (19, 9) that the mandibular intermolar width (L6-6) were larger in class I than in class II female samples. The mandibular molar alveolar widths (UA6-6) in this present study are significantly larger in class II than in class I female sample at $P < 0.05$, this finding are disagree with (19 , 8, 10) that the mandibular molar alveolar width (LA6-6) were no significantly differences between class I and class II female samples.

Conclusion

1- There were no significantly differences in all measurements between class I and class II overall samples.

2- There were no significantly differences in all measurements between class I and class II male samples except for mandibular intercanine widths (L3-3) were significantly larger in class II than in class I male samples.

3- There were no significantly differences in all measurements between class I and class II female samples except for mandibular molar alveolar widths (LA6-6) were significantly larger in class II than in class I female samples.

4- Most of the dental and alveolar widths measurements in overall, male and female class II samples were insignificantly slightly larger than in class I overall, male and female samples. These indicates that there were no posterior crossbite tendency in the class II groups .

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Table (1) The Distribution of Age in years of Class I and Class II samples

Sample	Class	Mean. Y	S.D.Y	Maximum. Y	Minimum. Y
Overall	C1 I	21	1.87	23	15
	C1 II	19.3	2.67	24	14
Males	C1 I	20.83	2.2	23	16
	C1 II	19.71	2.49	24	17
Females	C1 I	21.22	1.39	23	18
	C1 II	19.07	2.84	22	14

C1 I = class I; C1 II = class II,

S.D = standard deviation.

No. of class I= 40(males= 20 and females= 20)

No. of class II = 38 (males= 17 and females= 21) , Y = years

Table (2) Descriptive statistics of the dental and alveolar arch widths measurements in millimeters and *t*- test between overall samples of class I and class II

Dimensions	Class	Mean	S.D	Maximum	Minimum	P- Value	Sig. *
U 3-3	C1 I	34.99	1.99	39	31.5	0.41	N.S
	C1 II	35.65	2.82	42.5	31.25		
U 6-6	C1 I	52.82	4.36	60.5	44.5	0.47	N.S
	C1 II	51.87	3.30	58.5	46		
U A 6-6	C1 I	57.96	3.02	64	53.4	0.55	N.S
	C1 II	58.64	3.42	65.6	52		
L 3-3	C1 I	26.44	1.50	29	24	0.05	N.S
	C1 II	27.92	2.83	34	24		
L 6-6	C1 I	52.2	3.67	59	46.35	0.51	N.S
	C1 II	53.0	3.32	59	47		
L A 6-6	C1 I	57.12	3.11	64	52.5	0.09	N.S
	C1 II	59.01	3.06	66.5	55		

C1 I = class I; C1 II = class II;

S.D = standard deviation,

N.S= not significant at P > 0.05,

No. of overall class I sample = (40) (20 males and 20 females),

No. of overall class II sample = (38) (17males and 21 females)

Table (3) Descriptive statistics of the dental and alveolar arch widths measurements in millimeters and *t*- test between males samples of class I and class II

Dimensions	Class	Mean	S.D	Maximum	Minimum	P- Value	Sig. *
U 3-3	C1 I	35.84	1.57	39	33.5	0.08	N.S
	C1 II	37.67	2.72	42.5	35		
U 6-6	C1 I	55.19	4.35	60.5	44.5	0.72	N.S
	C1 II	54.48	3.01	58.5	50.5		
U A 6-6	C1 I	59.38	3.57	64	53.4	0.27	N.S
	C1 II	61.37	2.84	65.6	58.7		
L 3-3	C1 I	26.98	1.35	29	25	0.01	S *
	C1 II	29.44	2.73	34	26		
L 6-6	C1 I	54.56	2.59	59	50.3	0.66	N.S
	C1 II	55.12	2.84	59	51.7		
L A 6-6	C1 I	59.4	2.37	64	56	0.24	N.S
	C1 II	60.99	2.87	66.5	58.2		

C1 I = class I; C1 II = class II; S.D = standard deviation

*N.S= not significant,

S= significant at $P < 0.05$

No. of males class I sample = 20

No. of males class II sample = 17

Table (4) Descriptive statistics of the dental and alveolar arch widths measurements in millimeters and *t*- test between females samples of class I and class II

Dimensions	Class	Mean	S.D	Maximum	Minimum	P-Value	Sig. *
U 3-3	C1 I	33.95	2.04	36.8	31.5	0.75	N.S
	C1 II	34.24	1.96	37	31.25		
U 6-6	C1 I	49.92	2.07	52.6	47	0.71	N.S
	C1 II	50.31	2.42	53	46		
U A 6-6	C1 I	56.85	2.1	59	53.6	0.9	N.S
	C1 II	56.73	2.37	60.3	52		
L 3-3	C1 I	25.72	1.46	28.5	24	0.45	N.S
	C1 II	26.41	2.12	29.7	24		
L 6-6	C1 I	49.05	2.23	52.3	46.35	0.13	N.S
	C1 II	50.88	2.31	53.5	47		
L A 6-6	C1 I	54.84	1.81	58	52.5	0.02	S.*
	C1 II	57.02	1.72	60	55		

C1 I = class I; C1 II = class II;

S.D = standard deviation

*N.S= not significant,

S= significant at $P < 0.05$

No. of females class I sample = 20.

No. of females class II sample = 21