Contemporary Trends in Unilateral Cleft Lip Repair

Abstract

Background: Cleft lip is a common congenital facial malformation that significantly impacts the developmental, physical, and psychological aspects of a patient, and its occurrence is estimated to be 1 in 600 live births. **This study aimed to** assess outcome of fisher technique versus Millard technique in unilateral cleft lip repair functionally & aesthetically. **Methods:** The study was carried out on 20 patients who underwent to Unilateral Cleft lip repair in pediatric surgery outpatient clinic in Benha University Hospital. 20 patients were divided into two groups: Group A: 10 patients were operated by fisher technique and Group B: 10 patients were operated by Millard technique. **Results**: The postoperative lip height, vermilion height and nostril height were significantly higher in group B compared to group A (P<0.001, <0.001, <0.001), whereas the postoperative nostril width was significantly lower in group B compared to group A (P=0.002). There was an insignificant difference between both groups regarding the preoperative lip height, pre- and postoperative lip width, preoperative vermilion height, pre- and postoperative alar base, preoperative nostril height and width. **Conclusion:** In cases of unilateral cleft lip repair, the fisher anatomical subunit approach yielded more favorable outcomes and fewer adverse ones, as judged by the Steffensen criteria. However, there was no discernible variation in the general appearance of scars.

Keywords: Contemporary, Unilateral, Cleft lip, Repair.

Introduction

Cleft lip is a common congenital facial malformation that significantly impacts the developmental, physical, and psychological aspects of a patient, and its occurrence is estimated to be 1 in 600 live births. Therefore, good outcomes of cleft lip reconstruction are indispensable (1).

Cleft lip is the second most common congenital birth defect in the U.S. trailing only Down syndrome. There are roughly 7,000 infants born with oro-facial clefts in the U.S. annually (2)

.Various problems are observed in the patients such as dental disorders, poor occlusion, deformation of the face and nose and nutritional, respiratory, hearing and articulation problems (3).

Currently, various surgical techniques are used for the repair of unilateral cleft lip defects. Straight-line closure technique for the repair of unilateral defects was introduced in 1840s. Since then, various techniques have been implemented for such procedures (4).

The first documented cleft lip repair occurred in the fourth century AD in the Tang dynasty in China. The simple surgical technique involved incision and suturing of the

cleft edges, and the child was instructed not to speak post-operatively for about three months (2, 5)

Successful repair of cleft lip deformity is a challenging as well as rewarding task. Though localized to a small anatomic area, the face it demands more attention and priorities (6)

In the early 20th century, a Rose-Thompson method has developed as a straight-line technique, and was used by many surgeons. This technique was later found to have disadvantages in vertical scar formation that causes a notch in the upper lip, this condition has led many surgeons to develop other unilateral cleft lip surgery techniques, such as Millard and fisher techniques(7)

The treatment begins soon after the child's birth and continues until adulthood. The purpose of cleft treatment is aesthetic and functional rehabilitation. The surgical repair is important for facial growth preservation, normal speech formation and development of proper dentition. The less number of interventions, the less the scaring results and hence, growth retardation (8).

Millard developed rotational advancement method in 1964, which involves inserting lateral flap into upper part of lip & rotating medial part downward. Benefits of this method include reconstructing philtrum & Cupid's bow, transferring wound tension beneath base of ala, reducing nasal flare, & directing normal alveolar procedure progress (9).

Fisher's method borrowed idea of using sloped incisions to lengthen lip from Rose-Thompson method, which permitted him to construct smaller triangular flap above cutaneous roll, since explained by Noordhoff, with incisions respecting lip's anatomical subunits (10)

The purpose of this study was to assess outcome of fisher technique versus Millard technique in unilateral cleft lip repair functionally & aesthetically.

Patients and methods

The study was carried out on 20 patients who underwent to Unilateral Cleft lip repair in pediatric surgery outpatient clinic in Benha University Hospital.

An informed written consent was obtained from the parents of patients. Every parents of patient received an explanation of the purpose of the study and had a secret code number. The study was done after being approved by the Research Ethics Committee, Faculty of Medicine, and Benha University.

Inclusion criteria were both sex with 3 months to 6 months, non-syndromic unilateral cleft lip only, the patient has no other associated anomaly and intermediate gaping cleft lip.

Exclusion criteria were Patients refusing participation in the research, unfit for surgery, below 3 months and above 6 months, with syndromic cleft lip, associated cleft palate or

congenital anomalies, large or small gaps, severe maxillary or mandibular hypoplasia, and major co-morbid disease e.g. diabetes mellitus.

Grouping: 20 patients were divided into two groups: **Group A:** 10 patients were operated by fisher technique and **Group B:** 10 patients were operated by Millard technique.

All studied cases were subjected to the following: **Full history taking including** [Prenatal history: Mother's pregnancy, including any exposure to medications, alcohol, tobacco, or other potential teratogens and family history of cleft lip or palate, or other congenital anomalies, birth history: including gestational age, birth weight, and any complications, feeding history: assessing their ability to feed, weight gain, and any associated problems and medical history: Any other medical conditions, allergies, or previous surgeries, other potential congenital anomalies, developmental history: monitoring the infant's overall development]. **Physical examination including** [Detailed examination of the cleft: (Whether the cleft was complete or incomplete, the width and length of the cleft, the involvement of the nostril and nasal structures and Assessment of the alveolar ridge (gum line)), nasal examination: (The shape and symmetry of the nostrils was examined, any nasal deformities, such as alar base displacement), oral examination: A thorough examination of the oral cavity was essential to assess for any associated cleft palate or other oral anomalies, general physical examination, photographic documentation: preoperative photographs were essential for surgical planning and postoperative comparison, assessment of general health: Checking for any infections, and ensuring proper weight gain and presence of systemic disease or syndromes especially stickler syndrome, velocardiofacial syndrome, Pierre Robin sequence, Maxillary hypoplasia or mandibular hypoplasia]. **Lab investigations including** [Complete blood count, liver and kidney functions tests, coagulation profile, ECG and echocardiography when needed .for subjected cases of associated heart congenital anomalies, viral markers (Hepatitis b, c and HIV viral markers according to university hospital protocol) and audiometry and hearing function tests if suspected associated auditory anomalies].

Preoperative assessment

Local assessment of normal side versus cleft side in continuation of lip, cupids bow, white roll, wet to dry vermilion, oral commissure and assessment of nasal deformities like wide nostril base, shortening of columella and its shifting, hypoplasia of lower lateral cartilage of the nose, maxillary and mandibular hypoplasia and chin deviation

Operative

Broad spectrum antibiotic was given one shot of antimicrobial prophylaxis just before surgery after consultation of pediatric physician for calculating dose based on patient weight, All operations were carried out by general anaesthesia, Complete disinfection by bovidone iodine and toweling of surgical field, All patients were underwent marking important points of cleft lip marking: [Nadir of Cupid’s bow, Peak Cupid’s bow on noncleft and cleft sides, Wet–dry border on vermilion perpendicular to white roll marks,

Midline columellar base, Height of philtral columns at columellar base, Alar base and injection of local anesthetic solution (xylocain, adrenaline 1/200000)]

Group A: was subjected to Millard technique in unilateral cleft lip repair (9).

After infiltration with 1 in 200,000 adrenaline solution, the cleft edges were incised. The frenum was divided. The rotation incision was made through the full thickness of the lip, and a back cut was done. One can assess the adequacy of the rotation by ensuring that the Cupid's bow point was level with its noncleft side counterpart. The vermillion was pared leaving behind a good cuff of orbicularis oris muscle to be used as a filler to avoid a notch. The skin and mucosa were undermined. On the cleft side, after paring the edge, the advancement incision was made hugging the base of the ala and limiting the lateral extent of the incision to the minimum necessary. The vermillion was pared, leaving behind a cuff of muscle as on the medial side. An extensive lateral subperiosteal mobilization was performed from the alveolar shelf inferiorly to the infraorbital foramen superiorly and from the zygomatic prominence laterally to the edge of the maxilla medially. The mucoperiosteal lining was dissected off the underlying maxilla, releasing any tethering effect in the pyriform area. With such an extensive mobilization, even the widest of clefts can be brought together without any tension. Medially, an incision was made over the septomaxillary junction, extending posteriorly to the vomer. Anteriorly, it connects with the frenular base incision. The mucoperichondrium was dissected off the underlying nasal septum; septal repositioning is done in all patients. The nasal floor was created by suturing the septal mucoperichondrium medially with the mucoperiosteum on the maxilla laterally. Anterior palate repair is done to the extent possible. Ideally, we would like to close it till the hard and soft palate junction. When there was a discrepancy anteroposteriorly at the alveolar shelf level, it can be minimized by performing an unequal Z plasty described by Jackson. More than one such Z plasty were needed when there was gross alveolar disparity.

The Millard's cinch suture was placed with a nonabsorbable suture anchoring the paranasal muscles on the cleft side to the nasal septum. However, of late, we have been anchoring it to the midline mucoperiosteum with 4-0 monocryl. The false attachments of the orbicularis oris muscle were detached; the muscle was released from the mucosa and skin, more on the lateral aspect than on the medial. Nonabsorbable 5-0 polypropylene sutures were used to approximate the muscle for long-term stability. These have not been found to be the nidus for any infection later.

Group B: was subjected to fisher technique in unilateral cleft lip repair (11).

Injection of marked landmarks could make tattooing effect, to facilitate preserving landmarks effectively during surgical procedure. The incision on the medial segment was carried on with a no. 15 blade and redundant cleft marginal tissue was discarded. The skin on the medial segment was undermined from the skin and mucosa to separate orbicularis oris muscle for about 1 mm distal from cut edge. The incision on the lateral segment was carried on with a no. 15 blade, and excess marginal tissue was discarded. Dissection between skin and muscle on lateral element was done as same manner as medial side. The mucosal incision was closed with 5-0 Vicryl®. Upturned orbicularis oris

muscle at the alar base of cleft side was approximated to anterior nasal spine with 4-0 PDS®. Orbicularis oris muscle was overlapped and sutured with 5-0 Ethilon®. Medial and lateral lip flaps were approximated at the junction of red vermilion and cutaneous roll and then submucosal closure was done with 5-0 Vicryl®. Skin was closed with 6-0 Ethilon®. Upper vermilion flap was rotated and was sutured with 6-0 Vicryl®. Lip was closed with 5-0 Vicryl®. Infraorbital nerve block anesthesia was done with adrenaline 1/200000 epinephrine to reduce postoperative pain. Dressing was done using antibiotic ointment and Steri-strip®. Primary rhinoplasty routinely was done in both techniques by Tajima and Maccomb suture (12, 13).

Post-operative follows up

After recovery of anesthesia breast feeding was continued with use of safe local antiseptic to surgical suture wound, after 12 hours from recovery of anesthesia lab assessment of blood hemoglobin and haematocrite was done, discharges of patients were when breast feeding and post-operative hemostasis was secured and the patients were followed in pediatric surgery outpatient clinic at Benha university hospital.

Functional assessment

The baby weight growth was monitored at 3 months post-operative and 6 months post-operative and was compared with preoperative weight to assess efficacy of suckling power.

Aesthetic assessment

Post-operative scar assessment was done at 6 months post-operative using vancouver scar scale (VSC), and visual analog scale (VAS).

The multidimensional VAS was a photograph-based scale derived from evaluating standardized digital photographs in 4 dimensions (pigmentation, vascularity, acceptability, and observer comfort) plus contour. It sums the individual scores to get a single overall score ranging from “excellent” to “poor” (14) and vancouver scar scale: It assesses 4 variables: vascularity, height/thickness, pliability, and pigmentation.

Approval code:

Statistical analysis

Statistical analysis was done by SPSS v28 (IBM©, Armonk, NY, USA). The Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD) and were analyzed by unpaired student t-test. Paired sample t-test is a statistical technique that is used to compare two population means in the case of two samples that are correlated. Qualitative variables were presented as frequency and percentage (%) and analyzed using the Chi-square test or Fissure exact when appropriate. A two-tailed P value < 0.05 was considered statistically significant.

Results

There was an insignificant difference between both groups regarding demographic data (age and sex), cleft type and side **Table 1**

In group A (Millard technique), the postoperative lip height was significantly increased compared to preoperative lip height (P<0.001). There was an insignificant difference between preoperative and postoperative lip width, vermilion height, alar base, nostril height and width. In group B (Fisher technique), the postoperative lip height, vermilion height and nostril height were significantly higher compared to preoperative height (P<0.001, <0.001, <0.001). There was an insignificant difference between preoperative and postoperative lip width, alar base and nostril width. **Table 2**

The postoperative lip height, vermilion height and nostril height were significantly higher in group B compared to group A (P<0.001, <0.001, <0.001), whereas the postoperative nostril width was significantly lower in group B compared to group A (P=0.002). There was an insignificant difference between both groups regarding the preoperative lip height, pre- and postoperative lip width, preoperative vermilion height, pre- and postoperative alar base, preoperative nostril height and width. **Table 3**

Regarding the aesthetic outcome, postoperative VSS was significantly lower (better) in group B compared to group A (P<0.001). Regarding the Steffensen's grading criteria, although the good outcome was more prevalent in group B (Fisher technique) compared to group A (Millard technique), but with no significant difference between groups. There was an insignificant difference between both groups regarding the patients satisfaction regarding scar quality, despite higher satisfaction was highly observed in group B (Fisher technique) compared to group A (Millard technique). **Table 4**

Discussion

In group A (Millard technique), the postoperative lip height was significantly increased compared to preoperative lip height (P<0.001). There was an insignifcant difference between preopertaove and postoperative lip width, vermilion height, alar base, nostril height and width.

These results are in agreement with Abdullateef et al., (15) who found in 34 patients with unilateral cleft lip underwent Milard technique, greater increases in post-operative horizontal lip length and vertical lip height were observed (P<0.001).

In group B (Fisher technique), the postoperative lip height, vermilion height and nostril heighwere significantly higher compared to preoperative height (P<0.001, <0.001, <0.001). There was an insignifcant difference between preopertaove and postoperative lip width, alar base and nostril width.

Similar, Saeed et al.,(16) stated in 50 consecutive patients with primary unilateral incomplete cleft lip. Significant improvement in anthropometric parameters (vertical lip height, vermilion height, nostril width and nostril height) except lip width was recorded. Significant symmetry was achieved for all parameters (p-value less than 0.05) except

nasal height ratio (p- value=0.071). Good results were also achieved on all parameters according to Steffensen criteria.

In our study, the postoperative lip height, vermilion height and nostril hight were significantly higher in group B compared to group A (P<0.001, <0.001, <0.001), whereas the postoperative nostril width was significantly lower in group B compared to group A (P=0.002).

El-Maghraby et al., (17)revealed in unilateral cleft lip repair, Fisher anatomical subunit approximation method & Millard rotational advancement method were compared. Research included twenty studied cases who were repaired using each method. Lip height, vermilion height, & alar base length were significantly higher in Fisher category compared to Millard category, but there was no big variation in lip width.

Further, Gaber et al., (18) conducted a Prospective, randomized controlled research of 30 studied cases with unilateral cleft lip & palate; divided into two groups (Mohler and Fisher groups), admitted to Plastic Surgery Department; Qena University Hospital from May 2021 to April 2022 (one-year duration). They notified that lip height and vermilion height were higher in Fisher category associated to Mohler.

Regarding the aesthetic outcome, postoperative VSS was singnificalty lower (better) in group B compared to group A (P<0.001). Regarding the Steffensen's grading criteria, although the good outcome was more prevalnt in group B (Fisher technique) compared to group A (Millard technique), but with no significant difference between groups.

Gaber et al., (18) confirmed our result as they found that assessment of patient satisfaction between the two groups, reported that excellent esthetic outcomes were more frequent in Fisher group compared to Mohler group. Additionally, Saeed et al., (16) were on our side as they reported that fisher anatomical subunit repair is a reliable option for unilateral incomplete cleft lip repair producing aesthetically pleasing results.

Furthermore, According to Steffensen's grading criteria, Patel et al., (19) reported that good outcomes were more frequent in Fisher group compared Mohler group but without statistically significant difference. While poor outcomes were less frequent in Fisher group compared Mohler group but without statistically significant difference. Based on quantitative outcomes, he noted that Fisher anatomical subunit method may produce more reliable results regardless of severity of cleft.

Moreover, study by Deshmukh et al (20) that enrolled 50 studied cases with unilateral cleft lip with/without cleft palate. All studied cases were then randomly assigned to one of two lip repair methods. Research found no important variations in years old, gender, side, & extent of cleft among Fisher approach & Mohler technique categories. Comparison of immediate postoperative aesthetic results revealed that Fisher repair improved postoperative aesthetic results.

Added to that, Kwong et al. (21) in 2019 used eye-tracking technology to compare Fisher, Mohler, & Millard methods of unilateral cleft lip repair surgery & deduced that Fisher repair were best aesthetically, followed by Mohler technique, & finally Millard

one. This finding supports our previous findings that Fisher method for cleft lip repair can produce superior aesthetic results.

Also, Suchyta et al. (22) reported that more patients in Fisher group were satisfied in comparison to both Mohler and Millard techniques. Average ratings of nose symmetry, general appearance, & satisfaction with surgical outcome did not differ statistically significantly among repair organizations. Outcomes show that Fisher repair produced most favorable aesthetic results when compared to Millard & Mohler methods, especially in terms of scar severity.

Concerning the results, there was an insignifcasnt differance between both groups regarding the patient's satisfaction regarding scar quality, despite higher satisfaction was highly observed in group B (Fisher technique) compared to group A (Millard technique).

In accordance to our study, Pradnyandari al., (23) informed that regarding surgical scars and better aesthetic results were found in Fisher's technique compared to Millard's.

Moreover, ElMaghraby et al., (17) explored that scar presence was good in ninety percent of cases in Fisher's group & sixty five percent in Millard's group, as per Steffensen's grading criteria in their research, while poor outcomes were less frequent in Fisher group compared Millard group. They concluded that Fisher's method exceeded Millard's method. Alongside with our study, Shah et al., (24) observed scar severity was least severe with Fisher and most severe with Millard and Mohler.

Limitations were relatively small sample size inevitably lowered the statistical power of the analysis and Single-center study making the results less generalizable.

Conclusion

In cases of unilateral cleft lip repair, the fisher anatomical subunit approach yielded more favorable outcomes and fewer adverse ones, as judged by the Steffensen criteria. However, there was no discernible variation in the general appearance of scars.

Further investigations with larger and stratified sample size and multi-center study are recommended for more accurate results, we suggest using fisher anatomical subunit approximation method in unilateral cleft lip repair because it produces better scar outcomes than Mohler rotational progression method. However, both methods demonstrated clinically acceptable post-operative aesthetics, Fisher's technique performed better overall than Mohler's repair.

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Conflicts of interest

No conflicts of interest

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Table 1: Demographic data, cleft type and side of the studied groups

		Group A (Millard technique) (n=10)	Group B (Fisher technique) (n=10)	P value
Age (months)	**Mean± SD**	4.6± 1.26	4.3± 0.95	0.556
	Range	3-6	3-5	
Sex	**Male**	8 (80%)	7 (70%)	0.605
	Female	2 (20%)	3 (30%)	
Cleft type	**Incomplete**	4 (40%)	3 (30%)	0.639
	Complete	6 (60%)	7 (70%)	
Side	**Right**	5 (50%)	4 (40%)	0.653
	Left	5 (50%)	6 (60%)	

Table 2: Anthropometric measurements of the group A (Millard technique) and the group B (Fisher technique)

		Group A (Millard technique) (n=10)		P value
		Preoperative	Postoperative	
Lip height (cm)	**Mean± SD**	0.70± 0.07	0.93± 0.07	**<0.001***
	Range	0.58-0.8	0.86-1.05	
Lip width (cm)	**Mean± SD**	0.94± 0.03	0.95± 0.07	0.569
	Range	0.88-0.98	0.87-1.07	
Vermilion height (mm)	**Mean± SD**	0.86± 0.04	0.90± 0.04	0.073
	Range	0.82-0.92	0.82-0.95	
Alar base (mm)	**Mean± SD**	1.05± 0.29	1.13± 0.36	0.594
	Range	0.61-1.56	0.38-1.52	
Nostril height (mm)	**Mean± SD**	0.79± 0.04	0.82± 0.06	0.101
	Range	0.71-0.84	0.76-0.9	
Nostril width (mm)	**Mean± SD**	1.30± 0.12	1.34± 0.08	0.346
	Range	1.17-1.5	1.2-1.42	
Group B (Fisher technique) (n=10)				
Lip height (cm)	**Mean± SD**	0.74± 0.09	1.09± 0.08	**<0.001***
	Range	0.62-0.86	0.97-1.19	
Lip width (cm)	**Mean± SD**	0.94± 0.06	0.98± 0.08	0.318
	Range	0.87-1.03	0.88-1.09	
Vermilion height (mm)	**Mean± SD**	0.89± 0.03	1.06± 0.09	**<0.001***
	Range	0.85-0.94	0.9-1.17	
Alar base (mm)	**Mean± SD**	1.08± 0.32	1± 0.56	0.724
	Range	0.43-1.42	0.4-1.73	
Nostril height (mm)	**Mean± SD**	0.76± 0.05	0.96± 0.05	**<0.001***
	Range	0.7-0.83	0.9-1.04	
Nostril width (mm)	**Mean± SD**	1.29± 0.08	1.22± 0.07	0.068
	Range	1.18-1.42	1.1-1.3	

*: Statistically significant P value <0.05

Table 3: Anthropometric measurements of the studied groups

			Group A (Millard technique) (n=10)	Group B (Fisher technique) (n=10)	P value
Lip height (cm)	**Preoperative**	**Mean± SD**	0.70± 0.07	0.74± 0.09	0.312
		Range	0.58-0.8	0.62-0.86	
	Postoperative	**Mean± SD**	0.93± 0.07	1.09± 0.08	**<0.001***
		Range	0.86-1.05	0.97-1.19	
Lip width (cm)	**Preoperative**	**Mean± SD**	0.94± 0.03	0.94± 0.06	0.676
		Range	0.88-0.98	0.87-1.03	
	Postoperative	**Mean± SD**	0.95± 0.07	0.98± 0.08	0.467
		Range	0.87-1.07	0.88-1.09	
Vermilion height (mm)	**Preoperative**	**Mean± SD**	0.86± 0.04	0.89± 0.03	0.074
		Range	0.82-0.92	0.85-0.94	
	Postoperative	**Mean± SD**	0.9± 0.04	1.06± 0.09	**<0.001***
		Range	0.82-0.95	0.9-1.17	
Alar base (mm)	**Preoperative**	**Mean± SD**	1.05± 0.29	1.08± 0.32	0.839
		Range	0.61-1.56	0.43-1.42	
	Postoperative	**Mean± SD**	1.13± 0.36	1± 0.56	0.562
		Range	0.38-1.52	0.4-1.73	
Nostril height (mm)	**Preoperative**	**Mean± SD**	0.79± 0.04	0.76± 0.05	0.159
		Range	0.71-0.84	0.7-0.83	
	Postoperative	**Mean± SD**	0.82± 0.06	0.96± 0.05	**<0.001***
		Range	0.76-0.9	0.9-1.04	
Nostril width (mm)	**Preoperative**	**Mean± SD**	1.3± 0.12	1.29± 0.08	0.819
		Range	1.17-1.5	1.18-1.42	
	Postoperative	**Mean± SD**	1.34± 0.08	1.22± 0.07	**0.002***
		Range	1.2-1.42	1.1-1.3	

*: Statistically significant P value <0.05

Table 4: Postoperative aesthetic assessment by vancouver scar scale (VSS), outcome according to Steffensen's grading criteria and patients satisfaction regarding scar quality of the studied groups

		Group A (Millard technique) (n=10)	Group B (Fisher technique) (n=10)	P value
VSS	**Mean± SD**	5.6± 0.7	3.5± 0.53	**<0.001***
	Range	5-7	3-4	
Outcome	**Cutaneous roll symmetry**	6 (60%)	9 (90%)	0.303
	Vermilion symmetry	5 (50%)	8 (80%)	0.349
	Nostril symmetry	6 (60%)	7 (70%)	0.639
	Cupid's bow symmetry	6 (60%)	9 (90%)	0.303
	Alar dome symmetry	5 (50%)	6 (60%)	0.653
	Alar base symmetry	6 (60%)	8 (80%)	0.329
Patients' satisfaction	**Excellent**	4 (40%)	7 (70%)	0.478
	Good	4 (40%)	2 (20%)	
	Fair	1 (10%)	1 (10%)	
	Poor	1 (10%)	0 (0%)	

VSS: Vancouver scar scale, *: Statistically significant P value <0.05