# TESIS

## PENENTUAN KESIMETRISAN *ADITUS ORBITA* PADA TENGKORAK ASAL IRIAN SECARA KUANTITATIF MENGGUNAKAN ANALISIS FOURIER

*ANTROPOMETRI EKSPLORASI - CROSS SECTIONAL*



**ABDURACHMAN**

**PROGRAM PASCASARJANA**
**UNIVERSITAS AIRLANGGA**
**SURABAYA**
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## *ANTROPOMETRI EKSPLORASI - CROSS SECTIONAL*

# TESIS

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Dalam Program Studi Ilmu Kedokteran Dasar

Pada Program Pascasarjana Universitas Airlangga



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# BAB I

# PENDAHULUAN

# BAB I
# PENDAHULUAN



## 1.1. Latar Belakang Masalah

Hampir seluruh ciri-ciri *bilateral* pada manusia menunjukkan beberapa tingkatan *asymmetry*, misalnya, perbedaan antara sisi kanan dan kiri pada satu individu. Tingkat *asymmetry* ini berfluktuasi dan mempunyai batas nilai normal pada individu sesuai dengan batas nilai normal yang ada pada populasinya (Livshits dan Kobyliansky 1989).

Pada sisi lain terdapat laporan banyak kasus bahwa pengaruh lingkungan mempunyai dampak yang sangat bermakna pada *asymmetry* di dalam tubuh manusia sebagaimana yang terjadi pada binatang (Siegel dan Smookler 1973, Doyle dan Johnston 1977, Sciulli et al. 1979, Mooney et al. 1985, Kiesser et al. 1986).

Meskipun tengkorak adalah bagian tubuh yang paling sering menjadi bahan penelitian di bidang antropologi namun relatif sedikit yang diketahui darinya tentang ciri-ciri kesimetrisannya (Woo, 1931, Mullick, 1965, Vig and Hewitt, 1974).

Terdapat bukti pada manusia bahwa kedua belah sisi tengkorak tidaklah sama bentuknya, yakni sebagaimana yang ditemukan oleh Woo (1931) bahwa *os parietale* dan *os frontale* lebih panjang pada sisi kanan, sementara *os malare* lebih panjang pada sisi yang kiri. Penemuan tersebut menarik untuk dikaji lebih lanjut apakah *asymmetry* yang dimaksud berhubungan dengan *asymmetry* anatomis atau

fungsional lainnya (McManus, 1982). Hoadley dan Pearson (1929) menemukan panjang sisi dalam tengkorak cenderung lebih besar sisi kanan daripada sisi kiri. Pada pengukuran *orbita*, *apertura nasalis* dan *os zygomaticum* secara bermakna menunjukkan kecenderungan lebih besar pada sisi kanan sedangkan bagian bawah muka menunjukkan kecenderungan lebih besar pada sisi kiri (Hershkovitz, Ring, Kobyliansky 1992). Ferrario et al. (1997) mendapatkan *asymmetry* pada bentuk *condylus mandibulae*. Dengan menggunakan analisis Fourier mereka mendapatkan perbedaan yang sangat bermakna bentuk *(shape)* antara *condylus mandibulae* kanan dan kiri dalam satu individu. Sampel yang digunakan adalah hasil *orthopantomographs condylus mandibulae* kanan dan kiri 20 laki-laki dan 20 perempuan dengan usia rata-rata 29 tahun.

Kesimetrisan *aditus orbita* menarik untuk diteliti lebih lanjut karena tempatnya yang strategis pada daerah muka, tempat orang menjatuhkan pandangan pertama. Enlow (1982) mengatakan sangatlah perlu diperhatikan bahwa bentuk dan ukuran *orbita* merupakan kunci penting dalam hubungannya dengan pembentukan struktur wajah.

Namun, oleh karena penelitian-penelitian yang disebutkan terdahulu bukan mewakili populasi yang ada di Indonesia maka perlu dilakukan penelitian tersendiri dengan alasan, bahwa belum tentu *asymmetry orbita* sebagaimana yang telah diteliti sebelumnya berlaku juga pada populasi yang ada di Indonesia (Yen, 1973, Sularko 1979).

Salah satu suku bangsa di Indonesia yang secara historis cukup terisolasi

dari suku-suku lain yang ada adalah suku Irian. Oleh karena kondisi fisik Indonesia yang terdiri dari pulau-pulau dan keadaan lingkungan bagian timur wilayah Indonesia ini relatif jarang dikunjungi maka suku Irian relatif aman dari asimilasi dengan suku-suku yang lain Akibatnya suku Irian bisa diasumsikan suku yang relatif murni dan cukup representatif untuk menggambarkan populasi yang ada di Irian.

Demikian juga dengan semakin langkanya ahli anatomi pada akhir-akhir ini, khususnya di Laboratorium Anatomi UNAIR (jumlah yang purna tugas lebih banyak dari jumlah yang baru) dan sangat tipisnya minat untuk meneliti atau menjamah museum antropologi maka adanya tengkorak asal Irian yang cukup memadai merupakan motivator tersendiri untuk dilakukannya penelitian ini.

Salah satu tujuan utama penelitian *paleoanthropologis* adalah agar bisa membedakan tengkorak satu dengan yang lain dari populasi yang berbeda. Banyak sudah penelitian tentang tengkorak telah dilakukan melalui komparasi statistik ciri *metrik* maupun *non-metrik*. Pada penelitian ini penemuan tentang ciri kesimetrisan adalah relatif baru dan cukup menjanjikan (Hershkovitz, Ring, Kobyliansky, 1992).

Hal lain yang lebih penting adalah bahwa sesuai dengan Enlow (1982) ukuran dan bentuk *orbita* merupakan kunci penting dalam hubungannya dengan pembentukan struktur wajah. Sehingga dengan mengetahui kesimetrisan *aditus orbita* tengkorak asal Irian bisa dicari alasan apa yang melatarbelakanginya. Pengetahuan ini akan berguna nantinya antara lain untuk membantu identifikasi (kebanyakan kasus antropologi *forensik*) yang mana tengkorak merupakan barang

bukti yang cukup sering dipakai dan cukup lama bisa bertahan.

Manfaat lainnya adalah dalam bidang kedokteran pencegahan yaitu dengan mengarahkan seoptimal mungkin kesimetrisan wajah selama proses tumbuh kembang anak. Pengobatan pada kasus-kasus kecelakaan yang memerlukan rekonstruksi wajah, memperindah pada bidang estetika wajah dalam hubungannya dengan pemakaian kacamata dan lain-lainnya.

## 1.2. Permasalahan

Bagaimanakah kesimetrisan *aditus orbita* tengkorak asal Irian ?

Apakah pola kesimetrisan yang teramati sama dengan pola yang diamati oleh peneliti sebelumnya yang menggunakan bukan populasi Indonesia.

## 1.3. Tujuan Penelitian

Umum : Memperkaya data antropologi nasional dan internasional

Khusus : Mencoba mengaktualkan lagi peran museum antropologi (Laboratorium Anatomi-Histologi UNAIR khususnya)

Membuktikan kekhususan kesimetrisan *aditus orbita* tengkorak asal Indonesia (Irian)

Memanfaatkan keakuratan analisis Fourier pada analisis bentuk *aditus orbita*

## 1.4. Manfaat Penelitian

Fungsi diskriminasi dengan populasi yang lain, membedakan populasi

dalam penelitian ini dengan populasi yang lain.

Merangsang para ahli di bidangnya (khususnya di Laboratorium Anatomi FK. UNAIR) untuk mengoptimalkan fungsi museum antropologi.

Menbantu proses identifikasi pada antropologi *forensik*.

Mengoptimalkan tumbuhkembang yang simetris pada wajah anak.

Informasi penting terhadap bedah kosmetik, khususnya wajah.

Membantu informasi pada bidang estetika, tata rias wajah dan penggunaan kacamata.

# BAB II

# TINJAUAN PUSTAKA

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# TINJAUAN PUSTAKA

## 2.1. ANATOMI *ORBITA*

*Orbita* adalah suatu ruangan tulang yang berisi bola mata beserta otot-otot yang melengkapinya, syaraf, pembuluh darah, lemak dan banyak sekali *apparatus lacrimalis* (Gardner 1960). *Aditus orbita* sudah bisa diraba pada manusia hidup. Paling tidak *aditus orbita* dibentuk oleh tiga buah tulang (*os frontale, os zygomaticum dan os maxillae*) yang dipisahkan oleh tiga *sutura* (Gardner 1960).

Guna kenyamanan dalam mempelajarinya *aditus orbita* dibagi menjadi empat bagian sambung - menyambung, *supraorbitae, lateral, infraorbitae* dan *medial* yang masing-masing sesuai untuk ciri individu. Tepi *supraorbitae* dibentuk oleh *os frontale.* Tepi *lateral orbita* dibentuk oleh *processus zygomaticus ossis frontalis* dan *processus frontalis ossis zygomatici*, bentuknya cekung ke depan. Tepi *infra orbita* dibentuk oleh *os zygomaticum* dan *os maxillae.* Tepi *medial* dibentuk oleh *os maxillae, os lacrimale* dan *os frontale* (Gardner 1960).

*Orbita* mempunyai peran melindungi mata dan sebagai sarana melekat otot-otot yang menggerakkan bola mata . Atap *orbita* berfungsi sebagai penyangga *lobus frontalis* otak pada manusia modern (Aiello 1990).

## 2.2. PERTUMBUHAN *ORBITA*

*Orbita* menyempurnakan setengah dari pertumbuhan *postnatal*-nya selama dua tahun pertama kehidupan, sehingga terlihat terlalu besar pada wajah anak. Otak dan bola mata bertumbuh bersamaan dengan cepat, "mengisi" ruang, bentuk akhir dinding *orbita* mencerminkan penyesuaian antara berbagai *matrik* fungsional ini. *Cavum orbitae* mempertahankan dimensi dewasanya sejak umur tujuh tahun (Sperber 1991).

*Cavum nasi* terutama *septum nasi (intra uterin)* berpengaruh dalam menentukan posisi *orbita.* Pada *fetus ligamentum septomaxillare* muncul dari sisi dan tepi *anteroinferior septum nasi* dan masuk ke bagian depan *os nasale* meneruskan "tarikan" pertumbuhan *septum nasi* dan *os maxillae*. Pertumbuhan *os maxillae* diarahkan ke depan dan bawah melalui tulang rawan *septum nasi*, yang antara minggu ke 10-14, bertambah panjang *vertical* tujuh kali lipat. Pada saat lahir *cavum nasi* terletak hampir seluruhnya antara *orbita*. Pertumbuhan tulang rawan *septum nasi* berlangsung terus tetapi melambat sampai umur enam tahun, menurunkan *cavum nasi* di bawah *orbita* (Sperber 1991).

Ada pengaruh besarnya *lobus frontalis* otak terhadap ukuran *orbita* sesuai dengan pertumbuhannya. Jika *lobus frontalis* berbeda yang kanan dari yang kiri maka praktis *orbita* kanan juga akan berbeda dari yang kiri (Enlow 1982).

## 2.3. KESIMETRISAN *ORBITA*

Hershkovits et al. (1992) menerangkan bahwa tendensi lebih besar yang kanan daripada yang kiri pada wajah bagian atas (*orbita, apertura nasalis* dan *os zygomaticum*) sedang pada bagian bawah wajah cenderung lebih besar pada sisi yang kiri disebabkan oleh konsekuensi sekunder *asymmetry apparatus masticatorius*, mungkin oleh kebiasaan mengunyah lebih banyak sisi kiri dibandingkan yang kanan. Berbeda dengan hal tersebut di atas, *calvaria*, adalah bagian anatomi tubuh satu-satunya yang sisi kanannya senantiasa lebih dominan daripada sisi yang kiri. Kenyataan ini sudah sangat umum diketahui, paling tidak untuk jenis manusia. Rupanya hal ini sangat erat sekali kaitannya dengan dominansi *hemisphere cerebri* kanan daripada yang kiri. *Lateralisasi* dari fungsi otak ini hanya didapatkan pada manusia dan umumnya diasumsikan ada hubungannya dengan kemampuan berbicara.

Menarik untuk diungkapkan disini bahwa semakin besar penyimpangan ukuran tengkorak dari rata-rata populasinya semakin kuat terjadinya gangguan kesimetrisannya *(asymmetry)*. Sehingga boleh jadi "ukuran *asymmetry*" ini bisa memberikan informasi seberapa jauh dampak stressor lingkungan berpengaruh pada tumbuh kembang individu. Sehingga menyebabkan individu "berbeda" dari populasinya.

Vig dan Hewitt (1974) mengklaim bahwa *left-sided "excess"* daerah *infra maxilla* dan *basis cranii* pada anak-anak dapat diminimalkan dengan

jalan operasi pada struktur yang mempengaruhi tumbuh-kembang kompleks *dentoalveolaris* yang nantinya akan menyebabkan aktivitas yang simetris pada kedua sisi dan *intercuspasi* gigi yang maksimal.

*Asymmetry* pada wajah yang dia teliti tidak dipengaruhi oleh umur maupun jenis kelamin, namun daerah asal populasi mempunyai korelasi positif.

Selanjutnya efek pengaruh otot kunyah ini ditunjang oleh penemuan Möller (1966), Ahlgren (1966), Ingervall dan Thilander (1974), Ingervall dan Helkino (1978) bahwa pada manusia jelas terdapat hubungan antara fungsi otot kunyah terhadap bentuk wajah. Secara eksperimental laboratoris maupun dengan evaluasi klinis fungsi otot mempunyai pengaruh langsung terhadap proses pembentukan tulang. Oleh karena itu fungsi otot kunyah nantinya akan mempengaruhi bentuk *mandibula* (Engström et al, 1986). Bouvier dan Hylander (1984) membagi tikus cobanya dalam tiga kelompok, masing-masing diberikan diet dengan konsistensi fisik yang berbeda. Kelompok pertama diberikan diet keras, kelompok kedua diberikan diet lunak dan kelompok ketiga diberikan diet lunak pada awal masa percobaan kemudian diganti dengan diet keras pada akhir pengamatan. Percobaan yang dilakukan diamati dalam dua kurun waktu berurutan, 5 minggu dan 8 minggu. Secara *gross* anatomis dan histologis konsistensi diet tersebut memberikan efek berbeda pada *condylus mandibulae* dan secara beruntun juga mempengaruhi *maxillae*. Untuk mengurangi efek otot kunyah yang terlalu kuat pada salah satu sisi maka Kiliaridis et al. (1985) memakai diet lunak pada tikus cobanya.

Ramba (1998) menemukan tengkorak wanita Dolnì Vêstonice yang

mengalami *fractur ramus mandibulae* kiri, menyebabkan sisi kiri *orbita* berada lebih bawah dan lebih ke arah belakang dari yang kanan *(asymmetry)*. Penelitian yang dilakukan oleh Ramba. ini memusatkan perhatian pada *fractura condylus mandibulae* pada anak. Pada tahap berikutnya *fractura* dimaksud akan mempengaruhi pertumbuhan wajah secara keseluruhan termasuk pertumbuhan *orbita*, melalui efek tidak langsung oleh gaya yang ditimbulkan otot kunyah yang ber-*origo* pada *os mandibulae* dan ber-*insersi* pada *os zygomaticum dan os temporale*.

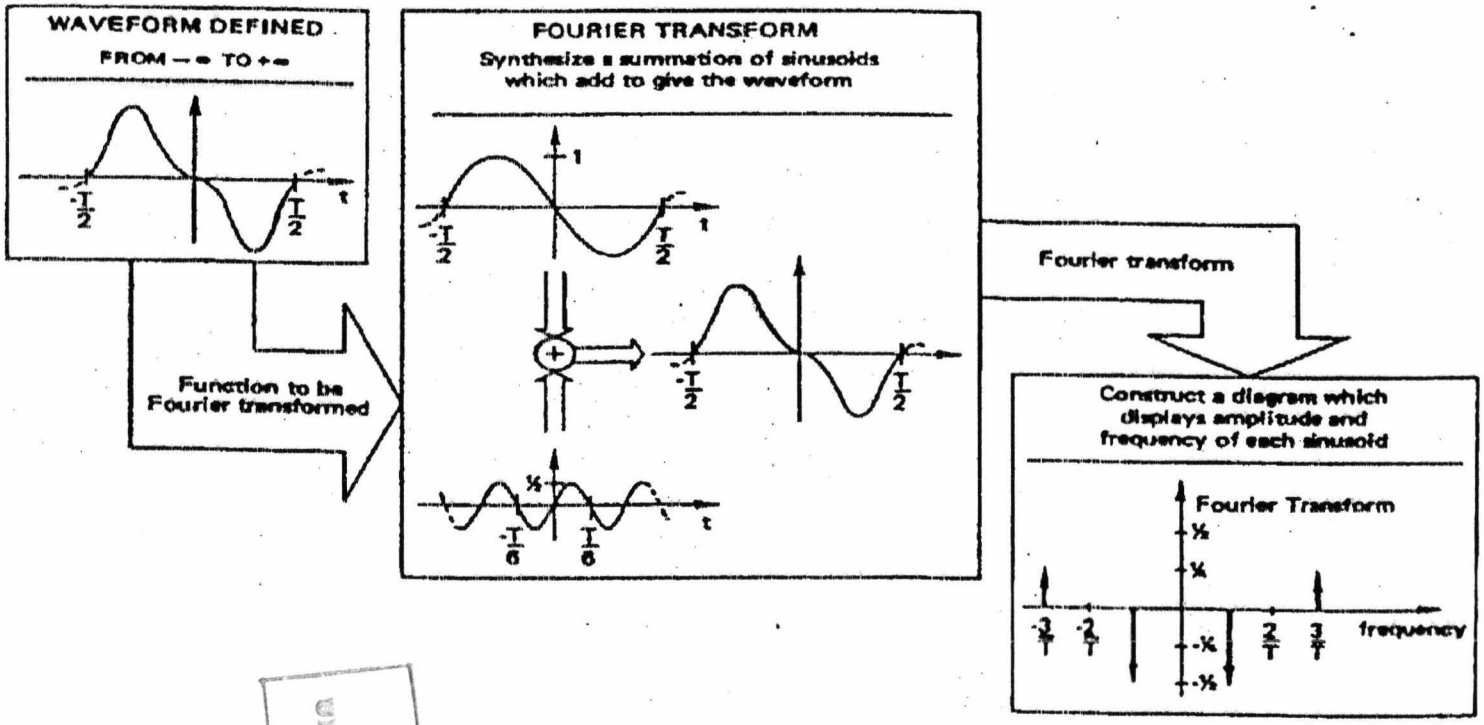
## 2.4. ANALISIS FOURIER

Secara tradisional, analisis Fourier sebagian besar penggunaannya terbatas pada bidang fisika dan tehnik.. Fourier (1768-1830) yang mula-mula merancang metode ini dalam hubungannya dengan problema tertentu yang timbul dari menganalisis konduksi panas. Hasilnya adalah sebuah rumus yang sejak itu penggunaannya berkembang meliputi bidang-bidang geologi, biologi, kedokteran dan lain-lain. Salah satu aplikasi utama dari analisis Fourier adalah untuk mendeteksi *" periodicity"* atau adanya elemen yang berulang pada suatu set data (Indrayana 1994).

Kegunaan *" Fourier series "* adalah bahwa ia menyajikan suatu pengukuran yang akurat dari suatu bentuk tidak beraturan yang kompleks.

Teori dari analisis Fourier ini adalah : suatu gelombang yang tidak konsisten diuraikan sebagai gabungan dari fungsi *trigonometri* yaitu, suatu gelombang *"cyclic"* adalah secara terpisah diekspresikan sebagai suatu fungsi *trigonometri* (Indrayana, 1994)

Gambar berikut mencoba memberikan contoh sederhana bagaimana suatu gelombang diuraikan menjadi dua gelombang penyusunnya.






Gambar : 2.1 (Brigham, 1988)

Penjabaran rumus dasar Seri Fourier adalah :

$$y(\theta) = a_0 + \sum_{i=1}^{n} a_i \cos i\theta + \sum_{i=1}^{n} b_i \sin i\theta$$

$a_0$ = konstanta

$a_i$ = koefisien Fourier bagian Cosinus

$a_0$ = koefisien Fouerier dari Sinus

$\theta$ = sudut, $0 < \theta < 2$

i - angka suatu titik posisi dari Fungsi

n = jumlah titik posisi-posisi dari Fungsi

Sebelum memahami seri Fourier secara detail, perlu diketahui beberapa istilah, yaitu:

1. *Period*; 2. Amplitudo; 3. Harmonik

Suatu *period* adalah satu siklus *sinusoidal* yang lengkap dengan interval dari 0 sampai 2. Dalam beberapa hal, suatu bentuk *ireguler* seperti tengkorak manusia dapat diperlakukan sebagai elemen-elemen yang berulang pada interval dari 0 sampai 2. Tinggi maksimum dari bentuk gelombang yang diukur dari sumbu X disebut amplitudo. Nilai ini sama dengan koefisien Fourier (a1 dan b1). Istilah harmonik menyatakan jumlah dari sinus dan cosinus.

Dalam penelitian ini. Karena *aditus orbita* dibagi menjadi 32 titik ($X_o$,$Y_o$) sampai ($X_{31}$, $Y_{31}$), maka kontur *aditus orbita* dianggap suatu gelombang dengan 32 titik.

Dari perhitungan seperti dalam Lampiran, maka akan didapatkan beberapa rumus dasar, yaitu :

$$(1)\quad A_o + \sum_{k=1}^{16} A_x \operatorname{Cos}\left[2\pi\, kx/32\right] + \sum_{k=1}^{16} B_x \operatorname{Sin}\left[2\pi\, kx/32\right]$$

$$(2)\quad A_o + \sum_{k=1}^{16} C_k \operatorname{Sin}\left[2\pi\, kx/32 + \phi_k\right]$$

$$(3)\quad A_o = \frac{1}{32} \sum_{k=0}^{31} Y_1$$

$$(4)\quad A_k = \frac{1}{16} \sum_{i=0}^{31} Y_1 \operatorname{Cos}\left[2\pi\, ki/32\right] \qquad (k = 1 \ldots 15)$$

$$(4')\quad A_{16} = \frac{1}{32} \sum_{i=0}^{31} Y_1 \operatorname{Cos}\left[\pi\, i\right]$$

$$(5)\quad B_k = \frac{1}{16} \sum_{i=0}^{31} Y_1 \operatorname{Sin}\left[2\pi\, ki/32\right] \qquad (k = 1 \ldots 15)$$

$$(5')\quad B_k = 0$$

$$(6)\quad C_k \sqrt{A_k^{\,2} + B_k^{\,2}} \qquad (k = 1 \ldots 16)$$

$$(7)\quad \Phi_k = \tan^{-1}\left[A_k + B_k\right] \qquad (k = 1 \ldots 16)$$

$$(8)\quad D_k = C_k / A_0 \times 100 \qquad (k = 1 \ldots 16)$$

$A_o$ dan $C_1$- $C_{16}$ Disebut *"Harmonic amplitude"* dan dihitung dengan rumus 3 sampai 6. $A_o$ menunjukan nilai rata-rata dari $Y_o$ sampai $Y_{31}$, dan menunjukkan keseluruhan besaran dari *aditus orbita*. $C_1$- $C_{16}$ menunjukan derajat lekukan dari bentuk kontur Jadi dengan cara ini, dihasilkan 17 nilai ($A_o$ dan $C_1$- $C_{16}$ ) untuk setiap gelombang.

Dengan menerapkan teori ini pada suatu bentuk kontur *aditus orbita* yang dianggap sebagai suatu gelombang *"cyclic"*, maka bentuk tidak beraturan ini dapat dikuantifikasi sebagai suatu fungsi *trigonometri*. Dengan demikian terbukalah kemungkinan menggambarkan bentuk-bentuk, yang selama ini hanya didiskripsi secara *morphognosis*, dalam bentuk variabel yang kontinu. Dengan demikian serangkaian statistik yang multivarian akan terjangkau, seperti Analisis Diskriminan, Analisis Cluster atau penggunaan statistik korelasi (Indrayana 1994).

Ferrario et al.(1996) mengunakan metode matematis analisis Fourier untuk menentukan perubahan bentuk *craniofacial* selama masa tumbuh kembang (usia satu sampai 18 tahun). Metode tersebut harus dipakai karena pengukuran *metric* secara konvensional hanya mampu menghasilkan data kuantitatif tentang ukuran *(size)* dengan mengesampingkan definisi bentuk *(shape)* dan modifikasinya.

Ferrario et al. (1997) menemukan bahwa pada penelitian rangka wajah pada manusia yang biasanya dibuatkan proyeksi *frontal*, *lateral* dan *orthopantomographs*-nya, pengukuran *linier* dan *anguler* hanya bisa menyediakan

data kuantitatif tentang ukuran *(size)* dan tidak bisa mendefinisikan bentuk *(shape)* rangka dan variasinya.

Metode yang tepat untuk mendapatkan bentuk (*shape*) secara kuantitatif adalah dengan menggunakan metode matematis yang kompleks semisal *Fourier series.*

Bentuk-bentuk yang kompleks diuraikan kedalam suatu serial fungsi *trigonometri, sinus dan cosinus*. Prinsip dasar inilah yang yang dipakai dalam analisis Fourier. Dengan metode tersebut bentuk-bentuk *(shapes)* kompleks mampu ditampilkan dengan angka. Oleh karenanya metode ini banyak dipakai dalam bidang biologi semisal neurologi ,kedokteran gigi, osteologi, hematologi dan onkologi.

Ada batasan tertentu terhadap jumlah koefisien Fourier yang representatif bisa diambil. Halazonetis et al. (1991) menguraikan bentuk *mandibulae* yang kompleks kedalam 8 koefisien Fourier. Mereka menilai jumlah tersebut cukup untuk melihat perubahan bentuk *mandibulae* pada usia pubertas. Menggunakan lebih dari jumlah tersebut mengakibatkan ketidaksesuaian dengan bentuk aslinya.

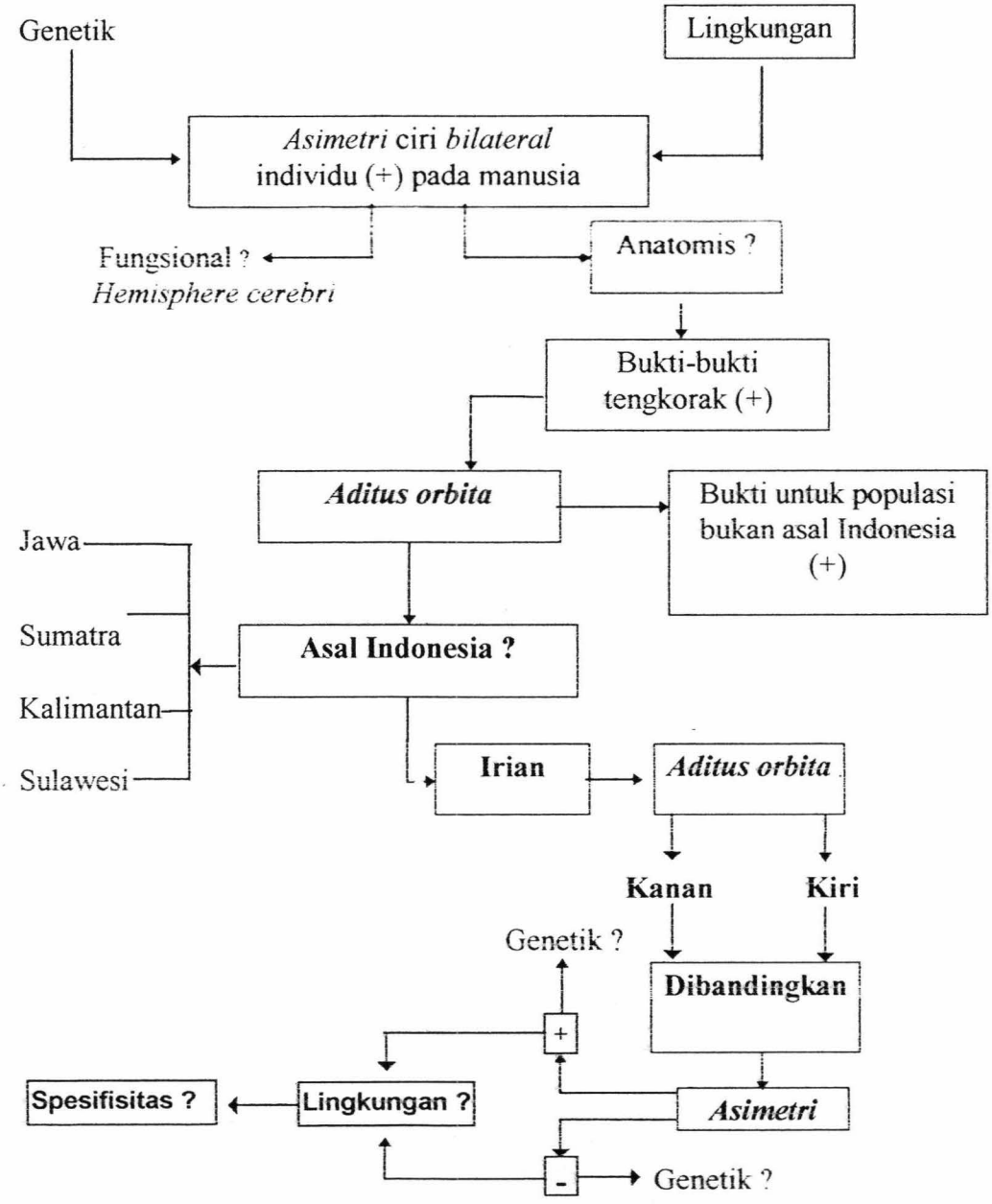
Schmittbuhl et al. (1999) menggunakan analisis Fourier untuk menentukan bentuk *(shape) orbita* manusia dan dibandingkannya dengan *Gorilla gorilla* dan *Pan troglodytes*. Dengan analisis Fourier tersebut mereka memberikan gambaran bentuk (*shape*) *orbita* secara kuantitatif, memperbaharui cara konvensional yang hanya menggambarkan bentuk (*shape*) *orbita* secara kualitatif: *rectangular*, *circular* dan *quadrangular*.

# BAB III

# KERANGKA KONSEP DAN HIPOTESIS PENELITIAN

# BAB III
# KERANGKA KONSEP DAN HIPOTESIS PENELITIAN

## 3.1. KERANGKA KONSEP PENELITIAN



## 3.2. HIPOTESIS PENELITIAN

1. Terdapat *asymmetry aditus orbita* tengkorak asal Irian
2. Pola *asymmetry* yang terjadi mempunyai karakter tersendiri.
3. Menentukan kesimetrisan *aditus orbita* lebih akurat menggunakan analisis Fourier daripada menggunakan tehnik pengukuran konvensional.

# BAB IV

# METODE PENELITIAN

# BAB IV
# METODE PENELITIAN

## 4.1 LOKASI DAN WAKTU

Pengambilan data dilakukan di Museum Anthropologi Laboratorium Anatomi Histologi Fakultas Kedokteran UNAIR Surabaya pada bulan Oktober 1999.

## 4.2 JENIS PENELITIAN

*Antropometri Eksplorasi - Cross sectional .*

## 4.3 VARIABEL

Klasifikasi Variabel :

Variabel *dependent* : ukuran *aditus orbita* (lebar, tinggi)

Bentuk *aditus orbita*

Variabel *independent* : kanan dan kiri

Definisi Operasional Variabel :

*Aditus orbita* : yang dimaksud dengan *aditus orbita* adalah pintu masuk menuju *Cavum orbita.*

Paling sedikit dibentuk oleh tiga buah tulang (*os frontale, os Zygomaticum* dan *os maxillae)*

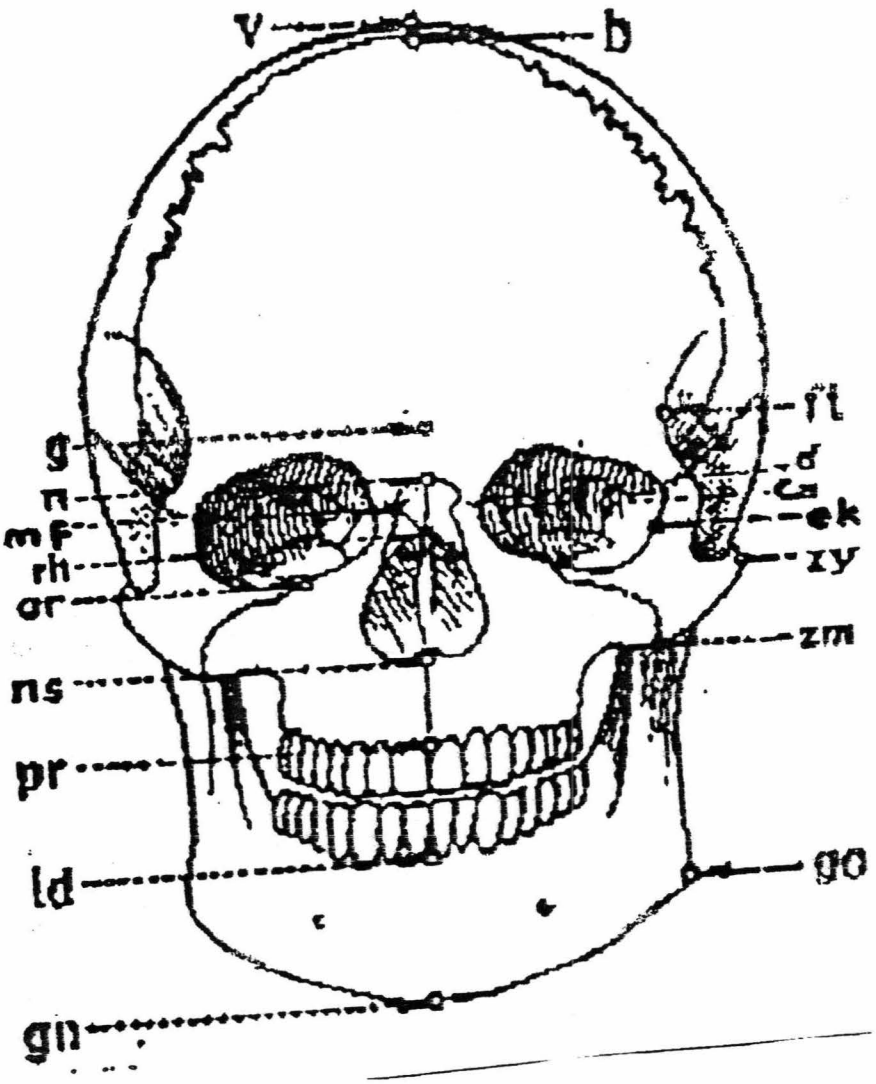
Titik-titik *craniometris* pada *aditus orbita*

*Mf : Maxillofrontale*

Titik tempat perpotongan antara *crista lacrimalis anterior* dengan *sutura frontonasalis.*

*Ek : Ektokonchion*

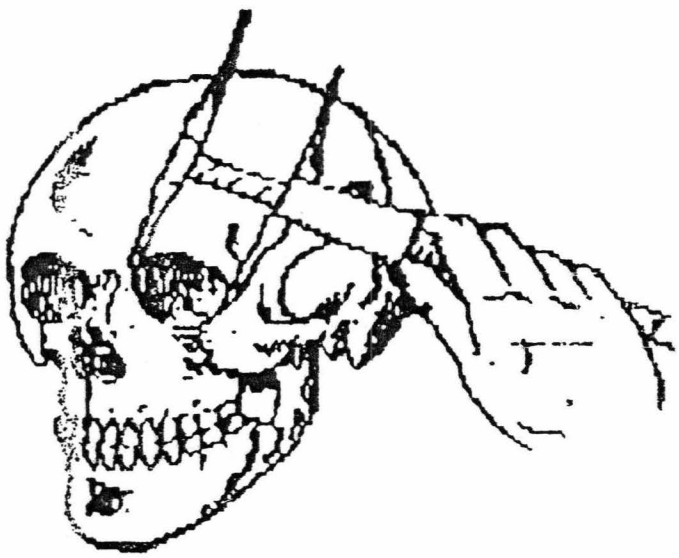
Titik dimana garis imajinatif yang keluar dari *maxillofrontale* dan sejajar Tepi atas *aditus orbita,* memotong tepi *lateral aditus orbita.*




Gambar : 4.1 (Glinka, 1990)

a. Lebar *aditus orbita (mf – ek)*

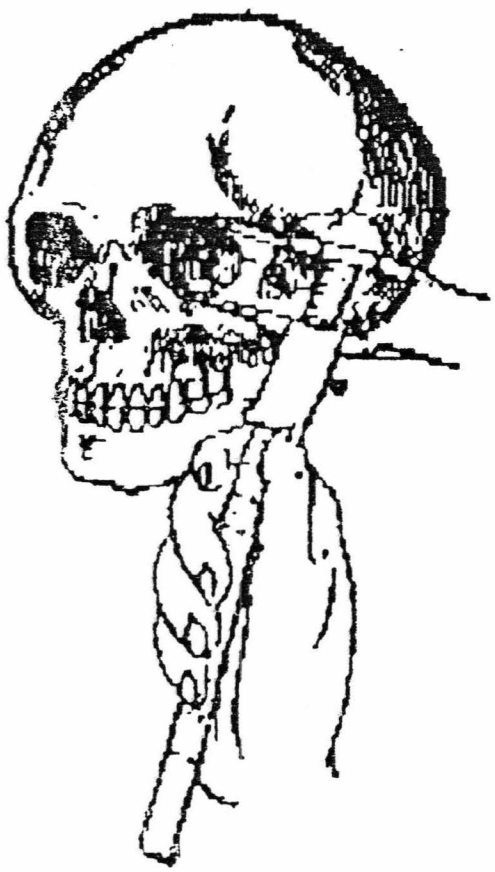
Jarak lurus antara *maxillofrontale* dan *ektokonchion (*garis miring sejajar dengan tepi atas *aditus orbita)*



**Gambar : 4.2 (Glinka, 1990)**

b. Tinggi *aditus orbita*

Jarak lurus antara tepi atas dan tepi bawah *aditus orbita* di tengah garis *mf* - *ek* dan tegak lurus terhadapnya (Glinka 1990).



**Gambar : 4.3 (Glinka, 1990)**

Bentuk *aditus orbita* : *elliptic* (Schmittbuhl et. al, 1999)

## 4.4 SAMPEL

Kriteria Sampel : Tengkorak asal Irian Jaya, berusia antara $35^{th}$-$60^{th}$ yang ada di Museum Antropologi Labotorium Anatomi-Histologi Fakultas Kedokteran UNAIR Surabaya dan masih utuh bentuk dan ukuran *aditus orbita*-nya, terdiri dari laki-laki dan perempuan, tidak dibedakan jenis kelaminnya oleh karena penelitian dilakukan terhadap individu yang sama menyangkut sisi kanan dan kiri, dan lagi Vig dan Hewitt (1974) menyatakan bahwa *asymmetry* pada wajah yang mereka teliti tidak dipengaruhi oleh umur maupun jenis kelamin, namun daerah asal populasi mempunyai korelasi positif.

Jumlah Sampel :

Terdiri dari 20 tengkorak (jumlah keseluruhan tengkorak asal Irian yang ada di museum yang masih memenuhi syarat untuk diteliti)

Metode Sampling :

Total sampling .



## 4.5 ALAT-ALAT

1. Clipper Geser
2. Kamera

Data teknis :

Tipe SLR

Fujica MPF 105

Fujinon 1 : 22

f : 55mm

Close up Lens IZUMAR +1

3. Hardware

Graphic Digitizer "Sketchmaster" GTCO model LCD-1211

Data teknis :

Interface : RS232C

Baud rate : 9600 baud

Asynchronous framing : 8 data bits, 1 stop bit, odd parity

Operating environment : 10 - 40°C

Switched stream digitizing mode

Output rate : 60 titi per detik

format binary, resolusi 0,002 " (500 per inch)

PC AT 286 Computer dengan suatu RS232C serial port

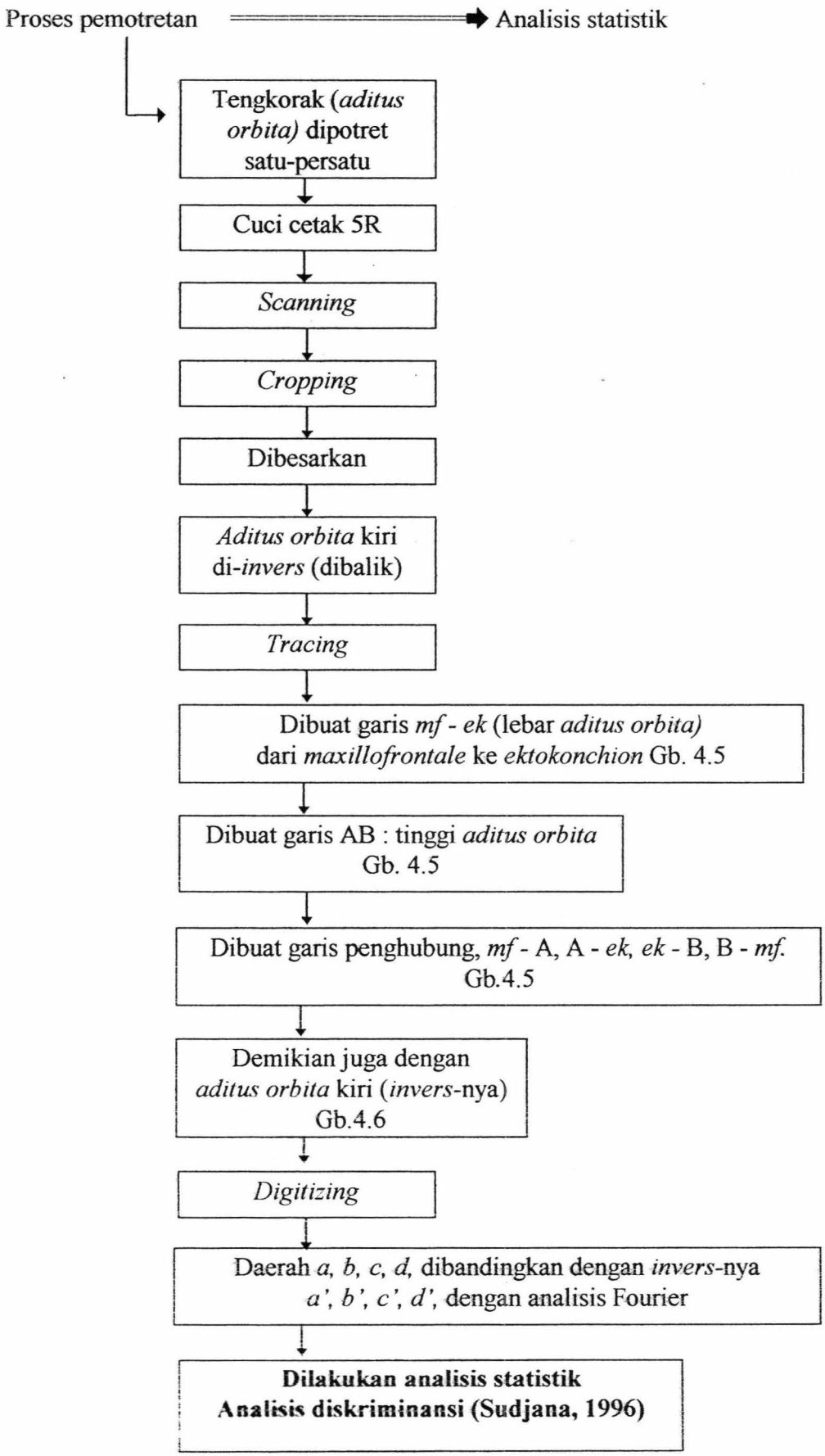
4. Software

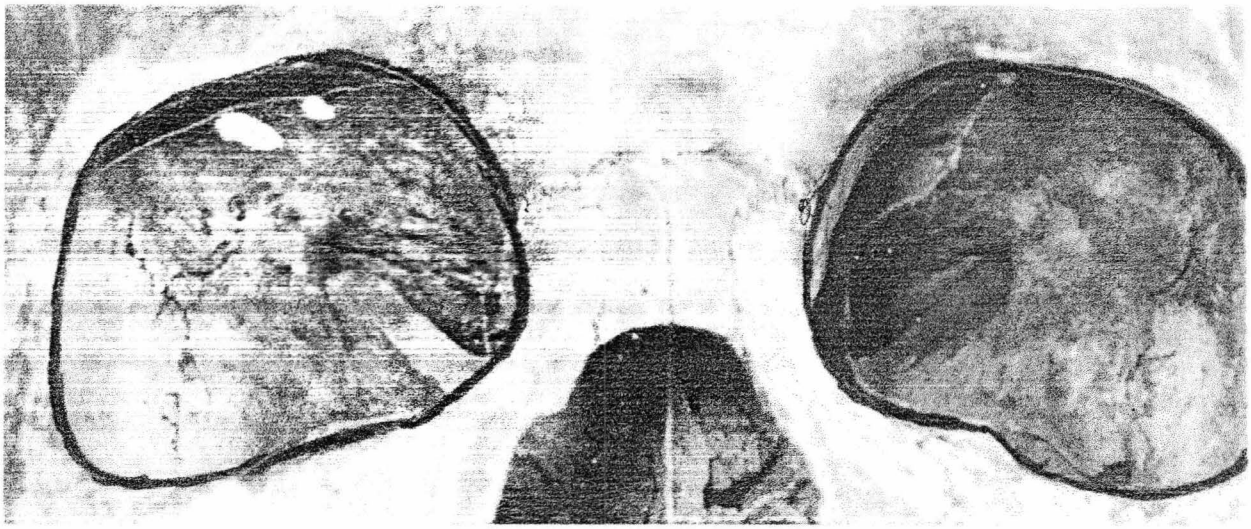
Program komputer dalam BASIC untuk *tracing* hasil pemotretan dengan digitizer, kemudian menghitung nilai "*normalized harmonic amplitudes*-nya".

## 4.6 PENGUMPULAN DATA, PENGELOLAHAN DATA DAN ANALISA DATA

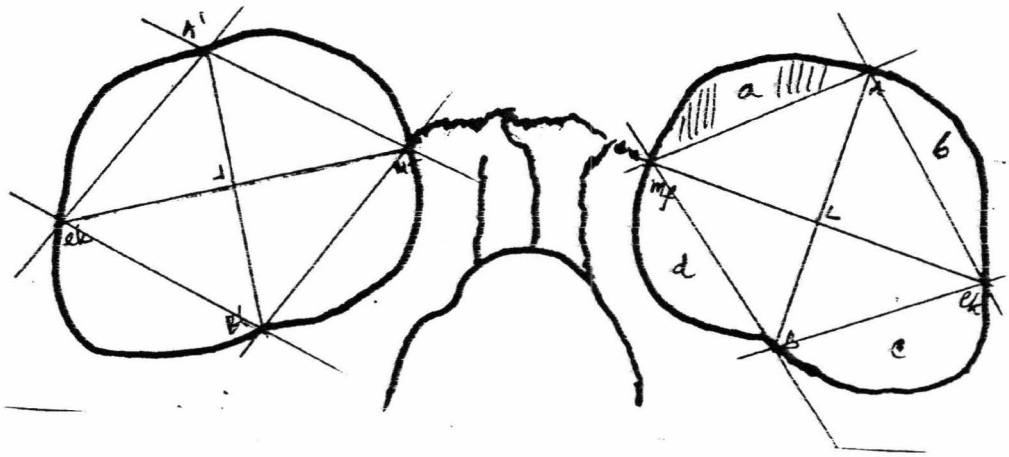
Pengumpulan Data :

Data dikumpulkan dari hasil pengukuran lebar dan tinggi *aditus orbita* masing-masing kanan dan kiri.

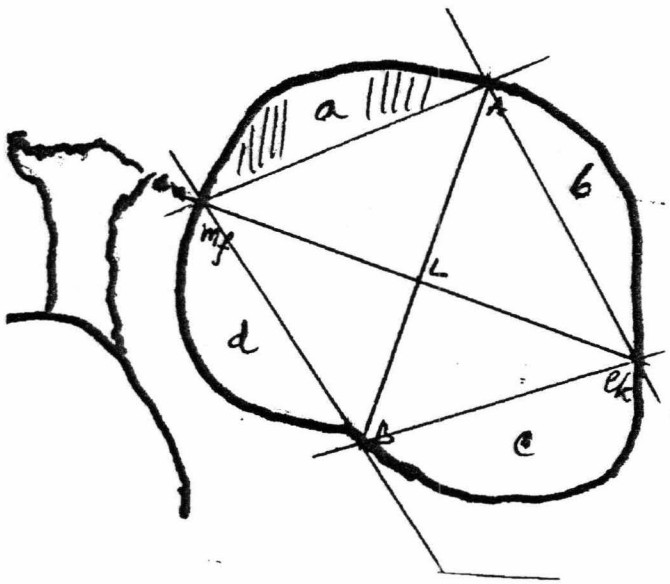




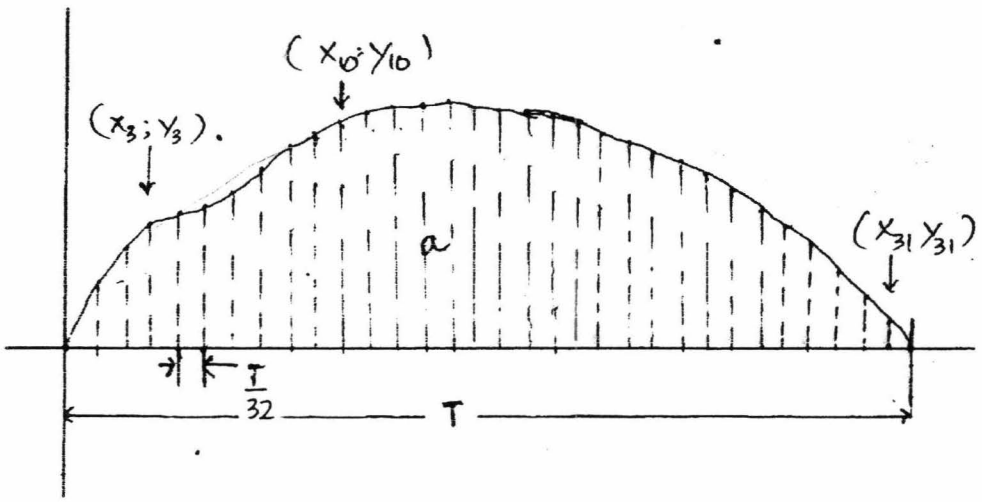
Gambar 4.4 *Cropped aditus orbita*




Gambar 4.5 Skematis *Cropped Aditus Orbita*




**Gambar 4.6 Skematis *Aditus orbita* kiri**




**Gambar 4.7 : Daerah (*a*) pada gambar 4.6. yang dibesarkan. Titik-titik sampling (32) dibuat dengan interval yang sama dimulai dari (Yo;Xo) hingga (Y31;X31) ditentukan secara otomatis oleh digitizer sewaktu *tracing*.Nilai Y kemudian dimasukkan kedalam rumus Fourier untuk ditentukan *Harmonic Amplitudes*-nya**

## 4.7 PROSEDUR PENELITIAN

Sebelum melakukan pengambilan data , dimintakan persetujuan terlebih dahulu kepada Kepala Laboratorium Anatomi Histologi Fakultas Kedokteran UNAIR Surabaya.

Melakukan pengukuran, pemotretan, *scanning, tracing, digitizing*. Hasilnya diproses dengan metode analisis Fourier di komputer.

# BAB V

# HASIL PENELITIAN

# BAB V

# HASIL PENELITIAN

Dari jumlah 20 tengkorak asal Irian yang diukur tinggi dan lebar *aditus orbita*-nya didapatkan hasil sebagai berikut :

**Tabel 5.1.**
**Hasil pengukuran tinggi (T) dan lebar (L) *aditus orbita* (dalam mm)**

| No | L_Kiri | T_Kiri | L_Kanan | T_Kanan |
|---|---|---|---|---|
| 01 | 47.1 | 35.0 | 39.0 | 34.7 |
| 02 | 46.4 | 33.9 | 46.1 | 33.0 |
| 03 | 39.9 | 31.6 | 41.2 | 31.2 |
| 04 | 38.6 | 33.8 | 40.9 | 32.6 |
| 05 | 39.9 | 34.1 | 38.9 | 33.3 |
| 06 | 42.1 | 33.2 | 40.4 | 31.6 |
| 07 | 41.2 | 35.0 | 42.8 | 33.5 |
| 08 | 40.1 | 32.7 | 40.2 | 32.9 |
| 09 | 41.7 | 33.8 | 42.6 | 34.5 |
| 10 | 43.1 | 30.6 | 43.9 | 31.0 |
| 11 | 41.2 | 31.6 | 42.8 | 32.0 |
| 12 | 38.1 | 31.3 | 39.4 | 32.0 |
| 13 | 40.9 | 32.0 | 39.8 | 32.0 |
| 14 | 44.4 | 36.2 | 45.9 | 38.0 |
| 15 | 39.2 | 34.6 | 39.4 | 33.7 |
| 16 | 44.1 | 29.9 | 43.2 | 29.8 |
| 17 | 40.0 | 35.3 | 40.5 | 33.2 |
| 18 | 41.7 | 33.3 | 41.0 | 32.4 |
| 19 | 45.4 | 33.2 | 46.0 | 32.4 |
| 20 | 44.4 | 32.3 | 46.8 | 31.2 |

Hasil analisis statistiknya :

**Tabel 5.2.**
**Statistik Dasar dan t-Test hasil pengukuran tinggi (T) dan lebar (L)**
***aditus orbita* kanan dan kiri 20 tengkorak asal Irian**

| Lokasi | Kanan | | Kiri | | t-value | Prob. |
|---|---|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. | | |
| Lebar | 4,1975 | ,2593 | 4,2040 | ,2571 | -0,080 | ,937 |
| Tinggi | 3,3170 | ,1666 | 3,2590 | ,1307 | 1,225 | ,228 |

Hasil Uji t-Test untuk lebar mempunyai nilai p= 0,937 artinya p>0,05 dan nilai p=0,228 untuk tinggi, atau p>0,05. Hasil ini menunjukkan bahwa hasil uji t-Test untuk ukuran tinggi dan lebar *aditus orbita* kanan dan kiri 20 tengkorak asal Irian tidak menunjukkan adanya perbedaan (tidak didapatkan *asymmetry*).

Tabel fungsi diskriminansi hasil analisis Fourier untuk bidang-bidang *(a)*, *(b)*, *(c)* dan *(d)*, lihat gambar 4.5. adalah sebagai yang terdapat pada halaman-halaman berikut :

Untuk bidang *(a)* tabel berikut menunjukkan nilai rata-rata dan galat baku hasil analisis Fourier-nya :

**Tabel 5.3.**
**Nilai rata-rata dan galat baku hasil analisis Fourier**
**Dari bidang (*a*), gambar 4.5.**

| lokasi | | Mean | Std. Deviation |
|---|---|---|---|
| kanan | VAR001 | 60,063318 | 9,3030166 |
| | VAR002 | 15,895314 | 3,3223948 |
| | VAR003 | 7,3460615 | 2,0761431 |
| | VAR004 | 4,4682993 | 1,5742243 |
| | VAR005 | 3,0872204 | ,9109817 |
| | VAR006 | 2,5436638 | ,7431152 |
| | VAR007 | 1,7942883 | ,6521686 |
| | VAR008 | 1,2947045 | ,5553513 |
| | VAR009 | 1,2271593 | ,4409041 |
| | VAR010 | 1,1366611 | ,3849640 |
| | VAR011 | ,9995436 | ,4447061 |
| | VAR012 | ,9333266 | ,4766064 |
| | VAR013 | ,8337194 | ,3790517 |
| | VAR014 | ,8386278 | ,3003764 |
| | VAR015 | ,7597708 | ,3204507 |
| | VAR016 | -,3723110 | ,1800712 |
| kiri | VAR001 | 63,439715 | 6,1168335 |
| | VAR002 | 15,434984 | 3,6105922 |
| | VAR003 | 6,6478302 | 1,6002968. |
| | VAR004 | 3,8818076 | 1,1401971 |
| | VAR005 | 2,8692361 | ,7246796 |
| | VAR006 | 2,0608657 | ,5377498 |
| | VAR007 | 1,5968539 | ,5248178 |
| | VAR008 | 1,2597121 | ,3179062 |
| | VAR009 | 1,0650326 | ,3812660 |
| | VAR010 | ,9255983 | ,2053635 |
| | VAR011 | ,7666744 | ,2841920 |
| | VAR012 | ,7061409 | ,1907498 |
| | VAR013 | ,6393546 | ,1528794 |
| | VAR014 | ,6770297 | ,1761747 |
| | VAR015 | ,6303714 | ,1559803 |
| | VAR016 | -,2786650 | ,1120173 |

Dari hasil analisis diskriminansi tabel 5.4 didapatkan perbedaan yang bermakna (p=0,024) pada variabel yang ke-6 dari hasil analisis Fourier untuk bidanng *(a)* pada *aditus orbita* (gambar 4.5.). Nilai rata-rata untuk variabel yang ke-6 (tabel 5.3.), kanan lebih tinggi dari yang kiri. Ini menunjukkan bahwa *harmonic aplitude* kanan lebih besar dari yang kiri atau kanan lebih kasar dari yang kiri.

Akurasi dalam penentuan *asymmetry* ini adalah 62,5% sesuai dengan tabel 5.5

**Tabel 5.4.**
**Hasil analisis fungsi diskriminan dari analisis Fourier bidang *(a)* secara *Stepwise*.**

**Variables Entered/Removed[a,b,c,d]**

| Step | Entered | Min. D Squared | | | | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | Between Groups | Exact F | | | |
| | | | | Statistic | df1 | df2 | Sig. |
| 1 | VAR006 | ,554 | kanan and kiri | 5,541 | 1 | 38,000 | 2,385E-02 |

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 32.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

**Tabel 5.5.**
**Derajat akurasi penentuan kanan dan kiri *aditus orbita* pada bidang *(a)*, gambar 4.5.**

**Classification Results[a]**

| | | | Predicted Group Membership | | |
|---|---|---|---|---|---|
| | | lokasi | kanan | kiri | Total |
| Original | Count | kanan | 13 | 7 | 20 |
| | | kiri | 8 | 12 | 20 |
| | % | kanan | 65,0 | 35,0 | 100,0 |
| | | kiri | 40,0 | 60,0 | 100,0 |

a. 62,5% of original grouped cases correctly classified.

**Tabel 5.6.**
**Nilai rata-rata dan galat baku hasil analisis Fourier untuk bidang *(b)*, gambar 4.5.**

| LOKASI | | Mean | Std. Deviation |
|---|---|---|---|
| kanan | VAR001 | 66,2135 | 7,2396 |
| | VAR002 | 15,2388 | 3,7590 |
| | VAR003 | 6,2184 | 1,6483 |
| | VAR004 | 3,7719 | ,8566 |
| | VAR005 | 2,4982 | ,6628 |
| | VAR006 | 1,6000 | ,6007 |
| | VAR007 | 1,3511 | ,6074 |
| | VAR008 | 1,1790 | ,3970 |
| ⇨ | VAR009 | ,8425 | ,3386 |
| | VAR010 | ,7768 | ,2947 |
| | VAR011 | ,7154 | ,2215 |
| | VAR012 | ,6933 | ,1827 |
| | VAR013 | ,5995 | ,2074 |
| | VAR014 | ,5255 | ,2400 |
| | VAR015 | ,4954 | ,2067 |
| | VAR016 | -,2916 | ,1068 |
| kiri | VAR001 | 62,3122 | 3,5168 |
| | VAR002 | 16,2048 | 2,3574 |
| | VAR003 | 6,8189 | ,9976 |
| | VAR004 | 4,0838 | ,5320 |
| | VAR005 | 2,5219 | ,5085 |
| | VAR006 | 1,8586 | ,6294 |
| | VAR007 | 1,5059 | ,5587 |
| | VAR008 | 1,1961 | ,3944 |
| ⇨ | VAR009 | 1,0595 | ,2195 |
| | VAR010 | ,8682 | ,2219 |
| | VAR011 | ,7083 | ,1900 |
| | VAR012 | ,6563 | ,2005 |
| | VAR013 | ,5847 | ,1830 |
| | VAR014 | ,6297 | ,1649 |
| | VAR015 | ,6147 | ,1759 |
| | VAR016 | -,2950 | 9,935E-02 |

**Tabel 5.7.**
**Hasil analisis fungsi diskriminan dari analisis Fourier bidang *(b)* secara *Stepwise*.**

**Variables Entered/Removed[a,b,c,d]**

| | | Min. D Squared | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Between | Exact F | | | |
| Step | Entered | Statistic | Groups | Statistic | df1 | df2 | Sig. |
| 1 | VAR009 | ,579 | kanan and kiri | 5,786 | 1 | 38,000 | 2,113E-02 |

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 32.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

Dari hasil analisis diskriminansi, sesuai pada tabel 5.7. didapatkan perbedaan yang bermakna (p=0,021) pada variabel yang ke-9 dari hasil analisis Fourier untuk bidanng *(b)* pada *aditus orbita* (gambar 4.5.) Nilai rata-rata untuk variabel yang ke-9 (tabel 5.6.), kiri lebih tinggi dari yang kanan. Ini menunjukkan bahwa *harmonic aplitude* kiri lebih besar dari yang kanan atau kiri lebih kasar dari yang kanan.

Akurasi dalam penentuan *asymmetry* ini adalah 65,0%

**Tabel 5.8.**
**Derajat akurasi penentuan kanan dan kiri *aditus orbita* pada bidang *(b)*, gambar 4.5.**

**Classification Results[a]**

| | | | Predicted Group Membership | | |
|---|---|---|---|---|---|
| | | LOKASI | kanan | kiri | Total |
| Original | Count | kanan | 12 | 8 | 20 |
| | | kiri | 6 | 14 | 20 |
| | % | kanan | 60,0 | 40,0 | 100,0 |
| | | kiri | 30,0 | 70,0 | 100,0 |

a. 65,0% of original grouped cases correctly classified.

**Tabel 5.9.**
**Nilai rata-rata dan galat baku hasil analisis Fourier Dari bidang ©, gambar 4.5.**

| lokasi | | Mean | Std. Deviation |
|---|---|---|---|
| kanan | VAR001 | 60,8185 | 5,7905 |
| | VAR002 | 16,5320 | 2,9998 |
| | VAR003 | 7,5545 | 1,6928 |
| | VAR004 | 4,4640 | 1,0717 |
| | VAR005 | 2,9366 | ,7185 |
| | VAR006 | 2,2161 | ,4961 |
| | VAR007 | 1,7419 | ,4967 |
| | VAR008 | 1,2170 | ,5075 |
| | VAR009 | 1,0747 | ,2976 |
| | VAR010 | ,9447 | ,2756 |
| | VAR011 | ,7910 | ,2530 |
| | VAR012 | ,7805 | ,1960 |
| | VAR013 | ,7352 | ,2025 |
| | VAR014 | ,7492 | ,2021 |
| | VAR015 | ,6828 | ,1952 |
| | VAR016 | -,3366 | ,1517 |
| kiri | VAR001 | 62,3909 | 6,0649 |
| | VAR002 | 15,8824 | 2,4733 |
| | VAR003 | 7,0659 | 1,4502 |
| | VAR004 | 4,3565 | ,6031 |
| | VAR005 | 2,6690 | ,5486 |
| | VAR006 | 2,0138 | ,5623 |
| | VAR007 | 1,7037 | ,4606 |
| | VAR008 | 1,1426 | ,3559 |
| | VAR009 | 1,0866 | ,2701 |
| | VAR010 | 1,0087 | ,2609 |
| | VAR011 | ,8443 | ,2267 |
| | VAR012 | ,7425 | ,2747 |
| | VAR013 | ,6648 | ,2199 |
| | VAR014 | ,7091 | ,2107 |
| | VAR015 | ,6155 | ,1868 |
| | VAR016 | -,2917 | ,1040 |

Dari data yang terdapat pada tabel 5.9. tidak ada variabel yang memenuhi syarat untuk bisa di-analisis secara *stepwise*, dengan kata lain tidak satupun variabel yang menunjukkan derajat perbedaan yang bermakna pada ($p<0,05$).

**Tabel 5.10**
**Nilai rata-rata dan galat baku hasil analisis Fourier dari bidang *(d)*, gambar 4.5.**

| lokasi | | Mean | Std. Deviation |
|---|---|---|---|
| kanan | VAR001 | 60,9001 | 5,0028 |
| | VAR002 | 16,0788 | 2,7841 |
| | VAR003 | 7,3126 | 1,4642 |
| | VAR004 | 4,2906 | ,7018 |
| | VAR005 | 2,9400 | ,5675 |
| | VAR006 | 2,1090 | ,5687 |
| | VAR007 | 1,6070 | ,5820 |
| | VAR008 | 1,3947 | ,5439 |
| | VAR009 | 1,2907 | ,3093 |
| | VAR010 | 1,0972 | ,2681 |
| | VAR011 | 1,0174 | ,2350 |
| | VAR012 | ,8861 | ,2215 |
| | VAR013 | ,8540 | ,2188 |
| | VAR014 | ,7604 | ,2066 |
| | VAR015 | ,7784 | ,2907 |
| | VAR016 | -,3501 | ,1512 |
| kiri | VAR001 | 62,7955 | 6,0573 |
| | VAR002 | 15,4668 | 2,7304 |
| | VAR003 | 7,2048 | 1,4327 |
| | VAR004 | 4,4487 | ,6244 |
| | VAR005 | 2,8631 | ,5716 |
| | VAR006 | 2,1634 | ,3847 |
| | VAR007 | 1,7368 | ,5141 |
| | VAR008 | 1,3902 | ,4563 |
| | VAR009 | 1,2240 | ,3373 |
| | VAR010 | 1,0184 | ,2458 |
| | VAR011 | ,8708 | ,2518 |
| | VAR012 | ,8114 | ,1799 |
| | VAR013 | ,7225 | ,1711 |
| | VAR014 | ,7405 | ,1953 |
| | VAR015 | ,6584 | ,1621 |
| | VAR016 | -,3342 | ,1007 |

Dari hasil analisis diskriminansi pada tabel 5.11 didapatkan perbedaan yang bermakna ($p=0,041$) pada variabel yang ke-13 dari hasil analisis Fourier untuk bidanng *(d)* pada *aditus orbita* (gambar 4.5.). Nilai rata-rata untuk variabel yang ke-13 (tabel 5.10.), kanan lebih tinggi dari yang kiri. Ini menunjukkan bahwa *harmonic amplitude* kanan lebih besar dari yang kiri atau kanan lebih kasar dari yang kiri.

Akurasi dalam penentuan *asymmetry* ini adalah 60,0% (tabel 5.12.)

**Tabel 5.11.**
**Hasil analisis fungsi diskriminan dari analisis Fourier bidang *(d)* secara *Stepwise***

**Variables Entered/Removed[a,b,c,d]**

| Step | Entered | Min. D Squared | | | | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | Between Groups | Exact F | | | |
| | | | | Statistic | df1 | df2 | Sig. |
| 1 | VAR013 | ,448 | kanan and kiri | 4,484 | 1 | 38,000 | 4,082E-02 |

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 32.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

**Tabel 5.12.**
**Derajat akurasi penentuan kanan dan kiri *aditus orbita* pada bidang *(d)*, gambar 4.5.**

**Classification Results[a]**

| | | | Predicted Group Membership | | |
|---|---|---|---|---|---|
| | | lokasi | kanan | kiri | Total |
| Original | Count | kanan | 12 | 8 | 20 |
| | | kiri | 8 | 12 | 20 |
| | % | kanan | 60,0 | 40,0 | 100,0 |
| | | kiri | 40,0 | 60,0 | 100,0 |

a. 60,0% of original grouped cases correctly classified.

# BAB VI

# PEMBAHASAN

# BAB VI

# PEMBAHASAN

Membandingkan *aditus orbita* kanan dan kiri secara *antropometric* konvensional melalui penentuan ukuran *(size)*, tidak menunjukkan adanya *asymmetry* (Tabel 5.2, $p < 0,05$)

Akan tetapi dengan membandingkan bentuk *aditus orbita* kanan dan kiri pada satu individu dengan metode kuantitatif analisis Fourier didapatkan adanya *asymmetry.*

Pada analisis Fourier *harmonic amplitude* menggambarkan karakteristik bentuk. Semakin tinggi *harmonic*-nya semakin besar jumlah gelombang yang dibentuk atau semakin kasar. Pada kuadran *(a)* (tabel 5.3.) *harmonic* no.6 nilainya lebih tinggi untuk *aditu orbita* kanan daripada yang kiri ($p < 0,05$). Hal ini menunjukkan bahwa daerah *mediocranial aditus orbita* kanan (Gambar 4.5) lebih kasar dari pada yang kiri. Demikian juga pada daerah *mediocaudal (d)*, *harmonic* no. 13 pada tabel (5.9.) nilai untuk *aditus orbita* kanan lebih tinggi daripada yang kiri dan ini berarti daerah *caudomedial aditus orbita* kanan lebih kasar dari yang kiri ($p < 0,05$).

Sebaliknya pada *quadran (b), harmonic* no.9 (tabel 5.6,) nilai *untuk aditus orbita* kiri lebih tinggi dari yang kanan ($p < 0,05$) dan ini berarti bahwa daerah *craniolateral aditus orbita* kiri lebih kasar dari yang kanan.

Untuk kuadran *(c)* tidak satupun variabel yang memenuhi syarat untuk bisa dianalisis diskriminansi, yang berarti bahwa daerah *caudolateral aditus orbita* tidak menunjukkan adanya *asymmetry*. Kondisi ini mungkin karena posisi

kuadran (*c*) yang berada pada daerah penyeimbang antara kuadran (*b*) yang lebih kasar pada sisi kiri dan kuadran (*d*) yang lebih kasar pada sisi kanan atau mungkin penentuan kesimetrisan *aditus orbita* ini harus menggunakan *elliptical Fourier analysis.*

Dengan pola *asymmetry* hasil penelitian sebagaimana diuraikan di atas, hampir pasti bahwa pola ini berbeda dengan populasi yang lain yaitu : Pada kuadran *(a)* (tabel 5.3.) ***harmonic*** **no.6** nilainya lebih tinggi untuk *aditu orbita* kanan daripada yang kiri, pada daerah *mediocaudal (d)*, ***harmonic*** **no. 13** pada tabel (5.9.) nilai untuk *aditus orbita* kanan lebih tinggi daripada yang kiri, pada *quadran (b),* ***harmonic*** **no.9** (tabel 5.6,) nilai *untuk aditus orbita* kiri lebih tinggi dari yang kanan sedangkan kuadran *(c)* tidak satupun variabel yang memenuhi syarat untuk bisa dianalisis diskriminansi.

Hasil penelitian ini, juga memberikan petunjuk bahwa analisis kuantitatif menggunakan analisis Fourier pada bentuk yang kompleks adalah lebih akurat.

Ferrario et al. (1997) menemukan bahwa pada penelitian rangka wajah pada manusia yang biasanya dibuatkan proyeksi frontal, lateral dan *orthopantomographs*-nya, pengukuran linier dan anguler hanya bisa menyediakan data kuantitatif tentang ukuran *(size)* dan tidak bisa mendefinisikan bentuk *(shape)* rangka dan variasinya.

Metode yang tepat untuk mendapatkan bentuk (*shape*) secara kuantitatif adalah dengan menggunakan metode matematis yang kompleks semisal *Fourier series.*

Hasil yang menunjukkan bahwa daerah *(a), craniomedial* dan *(d), caudomedial* (Gambar 4.5) kanan lebih kasar dari pada yang kiri bersesuaian dengan penemuan Woo (1931) bahwa *os parietale* dan *os frontale* lebih panjang pada sisi kanan dan Hoadley dan Pearson (1929) yang menemukan panjang sisi dalam tengkorak cenderung lebih besar sisi kanan daripada sisi kiri. Pada pengukuran *orbita*, *apertura nasalis* dan *os zygomaticum* secara bermakna menunjukkan kecenderungan lebih besar pada sisi kanan.

Bila hasil penelitian ini dikorelasikan dengan penelitian-penelitian sebelumnya maka didapatkan korelasi yang sinergis antara kekasaran daerah *mediocranial* dan *mediocaudal aditus orbita* kanan dengan terjadinya *asymmetry* pada *orbita* kanan dan kiri (Hershkovits et al.1992), yaitu yang kanan lebih besar dari yang kiri.

Sedangkan pada daerah *craniolateral (b)*, yang kiri lebih kasar dari yang kanan mungkin disebabkan oleh adanya pengaruh otot kunyah. Hal ini bersesuaian dengan Hershkovits et al. (1992) yang menerangkan bahwa tendensi lebih besar yang kanan daripada yang kiri pada wajah bagian atas (*orbita, apertura nasalis* dan *os zygomaticum*) sedang pada bagian bawah wajah cenderung lebih besar pada sisi yang kiri disebabkan oleh konsekuensi sekunder *asimetri apparatus masticatorius*, mungkin oleh kebiasaan mengunyah lebih banyak sisi kiri dibandingkan yang kanan.

Kebiasaan mengunyah pada sisi kiri ini nantinya akan memberikan dampak lebih dominannya otot kunyah pada sisi kiri daripada sisi kanan. Efek selanjutnya adalah diperlukannya massa otot kunyah yang lebih besar pada sisi kiri termasuk

juga area *origo* yang lebih kasar (*musculus masseter*, misalnya) yang ber-*origo* pada *os zygomaticum*. Kekasaran permukaan *os zygomaticum* ini diteruskan pula pada sisi tepi *aditus orbita* sisi *craniolateral*.

Sedangkan sudah jelas terjadinya efek pengaruh otot kunyah ini terhadap bentuk wajah telah diteliti oleh Möller (1966), Ahlgren (1966), Ingervall dan Thilander (1974), Ingervall dan Helkino (1978).

# BAB VII

# KESIMPULAN DAN SARAN

# BAB VII

# KESIMPULAN DAN SARAN

## KESIMPULAN

1. *Aditus orbita* kanan dan kiri pada satu individu adalah *asymmetry.*

   *Aditus orbita* kanan lebih kasar daripada yang kiri pada sisi *craniomedial* dan *caudomedial.*

   *Aditus orbita* kiri lebih kasar daripada yang kanan pada sisi *craniolateral* kemungkinan karena adanya pengaruh fungsi otot kunyah, yaitu kebiasaan mengunyah lebih banyak pada sisi kiri.

2. Pola *asymmetry* ini sangat mungkin berbeda dengan populasi yang lain dan karenanya bisa dijadikan salah satu ciri khas.

3. Penentuan kesimetrisan *aditus orbita* jauh lebih akurat menggunakan analisis kuantitatif Fourier dibandingkan jika hanya menggunakan metode konvensional pengukuran (*size*).

## S A R A N

Perlu dilakukan penelitian selanjutnya dengan menggunakan metode analisis Fourier secara eliptis (*elliptical Fourier analysis*).

Perlu dilakukan penelitian selanjutnya dengan menggunakan analisis Fourier pada tengkorak-tengkorak yang berasal dari daerah lain di Indonesia.

Meskipun analisis Fourier sangat akurat, tehnik pengukuran konvensional tidak begitu saja bisa ditinggalkan.

# DAFTAR PUSTAKA

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Aiello L, Dean C, 1990. An introduction to human evolutionary anatomy, Academic press, Harcaurt Brace Jovanich publishers, London, San Diego, New York, Berkerly, Boston, Sydney, Tokyo, Toronto.

Ahlgren J, 1966. Mechanism of Mastication. Acta Odontologica Scandinavia 24, Suplementum 44.

Bouvier M, and Hylander W L, 1984. The effect of dietary consistency on gross and histologic morphology in the craniofacial region of young rats. Am J Ana, 170: 117-126.

Brigham E O, 1988. The fast Fourier transform and its applicatios. Prentice-Hall International, Inc.

Doyle W J, and Johston D, 1977. On the meaning of increased fluctuating dental asymmetry across populational study. Am J Phys Anthropol, 46: 127-134.

Engstrom C, Kiliaridis S, and Thilander B, 1986. The relationships between masticatory function and craniofacial mophology. European Journal of Orthodontics, 8: 271-279.

Ferrario V F, Sforza C, Poggio C E, D'Addona A, and Taroni A, 1996. Fourier analysis of cephalometric shapes. Cleft Palate-Craniofacial Journal. Vol. 33 No. 3.

Ferrario V F, Sforza C, Miani Jr. A, and Sigurtà D, 1997. Asymmetry of normal mandibular condylar shape. Acta Anat 158: 266-273.

Gardner, Gray O'Rahilly, 1960. Anatomy, A regional study of human structur, W. B. Saunders Company, Philadelphia, London.

Glinka S V D, J, 1991. Antropometri dan Antroposkopi. FISIP. Universitas Airlangga, Surabaya.

Halazonetis D J, Shapiro E, Gheewalla R K, and Clark R E, 1991. Quantitative description of the shape of the mandible. Am J Orthod Dentofac Orthop ;99:49-56.

Hershkovitz I, Ring B, Kobyliansky E, 1992. Craniofacial asymmetry in Bedouin adults, Am. J Hum Biol, 4: 83-92.

Hoadly M F, and Pearson K, 1929. On measurements of the internal diameters of the skull in relation (I) to the prediction of its capacity (ii) to the preeminence of the left hemisphere. Biometrika, 21: 94-123.

Indrayana N S, 1994 Penentuan Jenis Kelamin Tengkorak Manusia Dengan Komputer Menggunakan Analisa Fourier Bentuk Dahi. Laporan Penelitian Lembaga Penelitian UNAIR. 9-10.

Ingervall B, Thilander B, 1974. Relation between facial morphology and activity of the masticatory muscles. Journal of Oral Rehabilitation 1:131- 147.

Ingerval B, Helkino E, 1978. Masticatory muscle force and facial morpology in man. Archives of Oral Biology 23: 203-206.

Kieser Y A, Groeneveld H T, and Preston C B, 1986. Fluctuating dental asymmetry as a measure of odontogenic canalization in man. Am J Phys Anthropol, 71:437-444.

Kiliaridis S, Engstrom C, Thilander B, 1985. The relationship between masticatory function and craniofacial morphology I. A cephalometric longitudinal analysis in the growing rat fed a soft diet. European Journal of Orthodontics, 7: 273-283.

Livshits G,and Kobyliansky E, 1989. Study of the genetic variance in the fluctuating asymmetry of anthropometrical trais, vol 16, 2: 121-129.

McManus I C, 1982. Short Reports. The distribution of skull asymmetry in man. Annals of Human Biology, vol. 9, No. 2: 167-170.

Möller E, 1966. The chewing apparatus. An electromyogrphic study of muscles of mastication and its correlation to facial morphology. Acta Phys Scand, 69: Suplement 280.

Mooney M P, Siegel P, Siegel M I, and Gest T R, 1985. Prenatal stress and increased fluctuating asymmetry and the parietal bones of neonatal rats. Am J Phys

Anthropol, 68: 131-134.

Mullick JF, 1965. An investigation of craniofacial asymmetry using the serial twin study method. Am J Orthodont 51: 112-119.

Ramba J, 1988. Asymmetry of female fascial skeletos ( Dolnì Vêstonice III and Brno III ) in the light of the recent studies. Anthropologie, 26,3: 197 - 205.

Schmittbuhl M, Le Minor J M, Allenbach B, Schaaf A, 1999. Shape of the orbital opening: individual characterization and analysis of variability in modern humans, Gorilla gorilla, and Pan troglodytes. Anat Anz 181:3 299-307.

Siegel M I, and Smookler H H, 1973. Fluctuating dental asymmetry and audiogenic. Growth 37: 35-39.

Sciulli P W, Doyle W J, Kelley C, Siegel P, and Siegel M I, 1979. The interaction of stressors in the induction of increased levels of fluctuating asymmetry in the laboratory rat. Am J Phys Anthropol, 46: 127-134.

Soelarko, 1979. Beberapa pengukuran cephalometrik pada tengkorak-tengkorak asal Indoneseia sebagai dasar bagi norma-norma protetik bangsa Indonesia. Angkasa, Bandung.

Sperber G H, 1991. Embryologi Kraniofasial ed. 4. Hipocrates, Jakarta.

Sudjana, 1996. Metoda Statistika ed. 6. Tarsito, Bandung.

Vig P, Hewitt AB, 1974. Is craniofacial asymmetry and adaptation for masticatory function an evolutionary process ? Nature 248 : 165.

Woo TL, 1931. On the asymmetry of the human skull. Biometrika 22 : 324-351.

Yen, P K J, 1973. The facial configuration in a sample of Chinese boys. Angle Orthod, 13: 301-304.

# LAMPIRAN

## LAMPIRAN I

## PENJABARAN RUMUS-RUMUS UNTUK ANALISIS FOURIER

Diketahui:

$$Y = A_o + \sum_{k=1}^{16} \left[ A_x \, Cos \, \frac{2\pi kx}{32} + B_x \, Sin \, \frac{2\pi kx}{32} \right]$$

Untuk $x = o \longrightarrow$ didapat $Y_0$

$x = 1 \longrightarrow$ didapat $Y_1$

$x = i \longrightarrow$ didapat $Y_i$

$x = 31 \longrightarrow$ didapat $Y_{31}$

Sehingga persamaan di atas dapat ditulis sebagai berikut :

$$Y_I = A_o + \sum_{k=1}^{16} \left[ A_k \, Cos \, \frac{2\pi ki}{32} + B_k \, Sin \, \frac{2\pi ki}{32} \right]$$

Untuk $i = 0, 1, 2, \ldots, 31$

Atau bisa juga dituliskan :

$$Y_I = A_o + \sum_{k=1}^{16} C_k \, Sin \left[ \frac{2\pi ki}{32} + \phi_k \right]$$

Untuk $i = 0, 1, 2, \ldots, 31$

Dari persamaan I didapat 33 konstanta yaitu :

$A_o, A_1, A_2, \ldots, A_{16}$ & $B_1, B_2, \ldots, B_{16}$

Cukup banyak untuk suatu fungsi trigonometri yang melalui 32 titik.

Khusus $A_o$ hanya dihitung melalui $Y_i$, sehingga secara langsung bisa diketahui

Khusus $A_o$ hanya dihitung melalui $Y_i$, sehingga secara langsung bisa diketahui melalui eksperimen.

$$Y_I = A_o + \sum_{k=1}^{16} \left[ A_k \, Cos \, \frac{2\pi ki}{32} + B_k \, Sin \, \frac{2\pi ki}{32} \right]$$

$$\sum_{i=0}^{31} Y_I = 32\,A_o + \sum_{i=0}^{31} \sum_{k=1}^{16} \left[ A_k \, Cos \, \frac{2\pi ki}{32} + B_k \, Sin \, \frac{2\pi ki}{32} \right]$$

$$= 32\,A_o + \sum_{k=1}^{16} \left[ A_k \sum_{i=0}^{31} Cos \, \frac{2\pi ki}{32} + B_k \sum_{i=0}^{31} Sin \, \frac{2\pi ki}{32} \right]$$

Sedangkan

$$\sum_{i=0}^{31} Cos \frac{2\pi ki}{32} = \frac{Sin \, \pi k \, . \, Cos \, \frac{31}{32} \pi k}{Sin \, \frac{\pi k}{32}} = 0$$

$$\sum_{i=0}^{31} Sin \frac{2\pi ki}{32} = \frac{Sin \, \pi k \, . \, Cos \, \frac{15}{16} \pi k \, - \, \frac{1}{2} \, Sin \, 2\pi k}{2 \left[ Sin \, \frac{\pi k}{32} \right]^2} = 0$$

$$\longrightarrow \sum_{i=0}^{31} Y_I = 32\,A_0 \longrightarrow \boxed{A_0 = \frac{1}{32} \sum_{i=0}^{31} Y_I}$$

$$Y_I = A_o + \sum_{k=1}^{16} \left[ A_k \, Cos \, \frac{2\pi ki}{32} + B_k \, Sin \, \frac{2\pi ki}{32} \right]$$

Kalikan ke 2 ruas dengan $Cos \frac{2\pi mi}{32}$ ( k = m )

$$Y_I \, Cos \, \frac{2\pi mi}{32} = A_o \, Cos \, \frac{2\pi mi}{32} + \sum_{k=1}^{16} \left[ A_k \, Cos \, \frac{2\pi ki}{32} + B_k \, Sin \, \frac{2\pi mi}{32} \right.$$

+

Kemudian dijumlahkan melalui indeks I dengan k = m

$$\longrightarrow \sum_{i=0}^{31} Y_I \, Cos \, \frac{2\pi mi}{32} = A_k \sum_{i=0}^{31} Cos \, \frac{2\pi mi}{32} +$$

$$\sum_{k=1}^{16} \left[ A_o \sum_{i=0}^{31} Cos \, \frac{2\pi ki}{32} \, . \, Cos \, \frac{2\pi mi}{32} + B_m \sum_{i=0}^{31} Sin \, \frac{2\pi ki}{32} \, . \, Cos \, \frac{2\pi mi}{32} \right]$$

Sedang diketahui

$$\sum_{i=0}^{31} Cos \, \frac{2\pi mi}{32} = \frac{Sin \, \pi m \, . \, Cos \, \pi m}{Sin \, \frac{\pi k}{32}} = 0$$

$$\sum_{i=0}^{31} \text{Cos}\ \frac{2\pi ki}{32} \cdot \text{Cos}\ \frac{2\pi mi}{32} = \frac{1}{2}\sum_{i=0}^{31}\left[1 + \text{Cos}\ \frac{2\pi ki}{16}\right] \quad \text{untuk } k = m$$

$$= \frac{1}{2}\left[32 + \sum_{i=0}^{31}\text{Cos}\ \frac{2\pi ki}{16}\right]$$

$$= 16 + \frac{1}{2} \cdot \frac{\text{Sin}\ 2\pi k \cdot \text{Cos}\ \frac{31}{16}\pi m}{\text{Sin}\ \frac{\pi k}{16}} = 16$$

$$\sum_{i=0}^{31} \text{Sin}\ \frac{2\pi ki}{32}\ \text{Cos}\ \frac{2\pi mi}{32} = \frac{1}{2}\sum_{i=0}^{31}\text{Sin}\ \frac{2\pi ki}{16} \quad \text{untuk } k = m$$

$$= \frac{1}{2}\left[\frac{\text{Sin}\ 2\pi k \cdot \text{Cos}\ \frac{15}{8}\pi k - \text{Sin}\ 4\pi k}{2\left[\text{Sin}\ \frac{\pi k}{16}\right]^2}\right] = 0$$

Sehingga didapat

$$\sum_{i=0}^{31} Y_i\ \text{Cos}\ \frac{2\pi mi}{16} = A_m \cdot 16 \longrightarrow A_k \cdot 16 = \sum_{i=0}^{31} Y_i\ \text{Cos}\ \frac{2\pi ki}{32}$$

$$\boxed{A_k = \frac{1}{16}\sum_{i=0}^{31} Y_i\ \text{Cos}\ \frac{2\pi ki}{32}} \qquad k = 1, 2, \ldots, 15$$

$$Y_i = A_o + \sum_{k=1}^{16}\left[A_k\ \text{Cos}\ \frac{2\pi ki}{32} + B_k\ \text{Sin}\ \frac{2\pi ki}{32}\right]$$

Kalikan ke 2 ruas dengan $\text{Sin}\ \frac{2\pi mi}{32}$ ( k = m )

$$Y_1\ \text{Sin}\ \frac{2\pi mi}{32} = A_o\ \text{Sin}\ \frac{2\pi mi}{32} + \sum_{k=1}^{16} \left[ A_k\ \text{Cos}\ \frac{2\pi ki}{32} + \text{Sin}\ \frac{2\pi mi}{32} \right.$$

$$\left. + B_k\ \text{Sin}\ \frac{2\pi ki}{32} \cdot \text{Sin}\ \frac{2\pi mi}{32} \right]$$

Kemudian dijumlahkan melalui indeks i dengan k = m

$$\sum_{i=0}^{31} Y_1\ \text{Sin}\ \frac{2\pi mi}{32} = A_0 \sum_{i=0}^{31} \text{Sin}\ \frac{2\pi mi}{32} +$$

$$\sum_{k=1}^{16} \left[ A_m \sum_{i=0}^{31} \text{Cos}\ \frac{2\pi ki}{32} \cdot \text{Sin}\ \frac{2\pi mi}{32} + B_m \sum_{i=0}^{31} \text{Sin}\ \frac{2\pi ki}{32} \cdot \text{Sin}\ \frac{2\pi mi}{32} \right]$$

Sedang diketahui

$$\sum_{i=0}^{31} \text{Sin}\ \frac{2\pi mi}{32} = \frac{\text{Sin}\ \pi m \cdot \text{Cos}\ \frac{15}{16}\pi m - \frac{1}{2}\ \text{Sin}\ 2\pi m}{2\left[\text{Sin}\ \frac{\pi m}{32}\right]^2} = 0$$

$$\sum_{i=0}^{31} \text{Cos}\ \frac{2\pi ki}{32} \cdot \text{Cos}\ \frac{2\pi ki}{32} = \sum_{i=0}^{31} \frac{1}{2}\ \text{Sin}\ \frac{2\pi mi}{16} \qquad \text{untuk k} = 0$$

$$= \frac{1}{2} \frac{\text{Sin } 2\pi k \ . \ \text{Cos } \frac{15}{8}\pi k \ - \ \text{Sin } 4\pi k}{2\left[\text{Sin } \frac{\pi k}{16}\right]^2} \ = \ 0$$

$$\sum_{i=0}^{31} \text{Sin } \frac{2\pi ki}{32} \ . \ \text{Sin } \frac{2\pi mi}{32} \ = \ \sum_{i=0}^{31} \left[\text{Sin } \frac{2\pi ki}{32}\right]^2 \quad \text{untuk } k \ = \ m$$

$$\sum_{i=0}^{31} \frac{1}{2}\left[\ 1 \ - \ \text{Cos } \frac{2\pi ki}{32}\ \right]$$

$$= 16 \ - \ \frac{1}{2} \sum_{i=0}^{31} \text{Cos } \frac{2\pi ki}{32}$$

$$= 16 \ - \ \frac{1}{2} \ . \ \frac{\text{Sin } 2\pi k \ . \ \text{Cos } \frac{31}{16}\pi k}{\text{Sin } \frac{\pi k}{16}} \ = \ 16$$

$$\longrightarrow \sum_{i=0}^{31} Y_i \ \text{Sin } \frac{2\pi mi}{32} \ = B_m \ . \ 16$$

$$\longrightarrow B_k \ . \ 16 \ = \ \sum_{i=0}^{31} Y_i \ \text{Sin } \frac{2\pi ki}{32}$$

$$\longrightarrow \qquad \boxed{B_k \ = \frac{1}{16} \sum_{i=0}^{31} Y_i \ \text{Sin } \frac{2\pi ki}{32}} \qquad k \ = \ 1, 2, 3, \ldots, 15$$

untuk k = 16 $\qquad B_k = \frac{1}{16} \sum_{i=0}^{31} Y_1 \, \text{Sin} \, \pi i \,,$

$\longrightarrow$

karena $\text{Sin} \, \pi i = 0 \longrightarrow \boxed{B_{16} = 0}$

$$Y_1 = A_o + \sum_{k=1}^{16} \left[ A_k \, \text{Cos} \, \frac{2\pi ki}{32} + B_k \, \text{Sin} \, \frac{2\pi ki}{32} \right]$$

$$= A_o + \sum_{k=1}^{15} \left[ A_k \, \text{Cos} \, \frac{2\pi ki}{32} + B_k \, \text{Sin} \, \frac{2\pi ki}{32} \right] +$$

$A_{16} \, \text{Cos} \, \pi i + B_{16} \, \text{Sin} \, \pi i$

$$\longrightarrow Y_1 = A_o + A_{16} \, \text{Cos} \, \pi i + \sum_{k=1}^{15} \left[ A_k \, \text{Cos} \, \frac{2\pi ki}{32} + B_k \, \text{Sin} \, \frac{2\pi ki}{32} \right]$$

$$Y_1 = A_o + A_{16} \, \text{Cos} \, \pi i + \sum_{k=1}^{15} \left[ \frac{1}{16} \sum_{i=0}^{31} Y_1 \, \text{Cos} \, \frac{2\pi ki}{32} \, \text{Cos} \, \frac{2\pi ki}{32} \right.$$

$$\left. + \frac{1}{16} \sum_{i=0}^{31} Y_1 \, \text{Sin} \, \frac{2\pi ki}{32} \, \text{Sin} \, \frac{2\pi ki}{32} \right]$$

$$Y_1 = A_o + A_{16} \, \text{Cos} \, \pi i + \frac{1}{16} \sum_{k=1}^{15} \sum_{i=0}^{31} \left[ Y_1 \left[ \text{Cos} \, \frac{2\pi ki}{32} \right]^2 + Y_1 \left[ \text{Sin} \, \frac{2\pi ki}{32} \right]^2 \right]$$

$$Y_1 = A_o + A_{16} \, \text{Cos} \, \pi i + \frac{1}{16} \sum_{i=0}^{31} \left[ Y_1 \sum_{k=1}^{15} \left[ \text{Cos} \, \frac{2\pi ki}{32} \right]^2 + Y_1 \sum_{k=1}^{15} \left[ \text{Sin} \, \frac{2\pi ki}{32} \right]^2 \right]$$

Sedang

$$\sum_{k=1}^{15} \left[ \text{Cos } \frac{2\pi ki}{32} \right]^2 = \sum_{k=1}^{15} \frac{1}{2} \left[ 1 + \text{Cos } \frac{2\pi ki}{16} \right]$$

$$= \left[ \frac{15}{2} + \sum_{k=1}^{15} \text{Cos } \frac{2\pi ki}{16} \right] = \frac{15}{2} + \frac{\text{Sin} \left( 15 + \frac{1}{2} \right) \frac{2\pi i}{16}}{2 \text{ Sin } \frac{1}{2} \cdot \frac{2\pi i}{16}} - \frac{1}{2}$$

$$= 7 + \frac{\text{Sin } \frac{31}{16} \pi i}{2 \text{ Sin } \frac{\pi i}{16}}$$

$$\sum_{k=1}^{15} \left[ \text{Sin } \frac{2\pi ki}{32} \right]^2 = \sum_{k=1}^{15} \frac{1}{2} \left[ 1 - \text{Cos } \frac{2\pi ki}{16} \right]$$

$$= \left[ \frac{15}{2} - \sum_{k=1}^{15} \text{Cos } \frac{2\pi ki}{16} \right] = \frac{15}{2} - \frac{\text{Sin } \frac{31}{16} \pi i}{2 \text{ Sin } \frac{\pi i}{16}} + \frac{1}{2}$$

$$= 8 - \frac{\text{Sin } \frac{31}{16} \pi i}{2 \text{ Sin } \frac{\pi i}{6}}$$

$$Y_1 = A_o + A_{16} \text{ Cos } \pi i + \frac{1}{16} \sum_{i=0}^{31} \left[ Y_1 (15) \right]$$

$$Y_1 = A_o + A_{16} \text{ Cos } \pi i + 15 \left[ \frac{1}{16} \sum_{i=0}^{31} Y_1 \right]$$

$$Y_1 = A_o + A_{16} \text{Cos } \pi i + 30\, A_o = 31\, A_0 \text{Cos } \pi i + A_{16} \text{ Cos } \pi i$$

Kedua ruas dikalikan Cos $\pi i$

$$\longrightarrow Y_1 = A_o + A_{16} \text{Cos } \pi i + 30\, A_o = 31\, A_0 \text{Cos } \pi i + A_{16} \left[\text{Cos } \pi i\right]^2$$

Kemudian dijumlahkan menurut indeks i

$$\sum_{i=0}^{31} Y_1 \text{Cos } \pi i = 31\ A_0 \sum_{i=0}^{31} Y_1 \text{Cos } \pi i + A_{16} \sum_{i=0}^{31} (\text{Cos } \pi i)^2$$

Sedang diketahui

$$\sum_{i=0}^{31} \text{Cos } \pi i = 0$$

$$\sum_{i=0}^{31} (\text{Cos } \pi i)^2 = \frac{1}{2} \sum_{i=0}^{31} \left[1 + \text{Cos } 2\pi i\right]$$

$$= \frac{1}{2}\left[32 + \sum_{i=0}^{31} \text{Cos } 2\pi i\right] = \frac{1}{2}\,(32 + 32) = 32$$

$$\longrightarrow \sum_{i=0}^{31} Y_i \text{ Cos } \pi i = A_{16} \,.\, 32$$

$$\boxed{A_{16} = \frac{1}{32} \sum_{i=0}^{31} Y_i \text{ Cos } \pi i}$$

Diketahui

$$Y_1 = A_o + \sum_{k=1}^{16} \left[ A_k \, Cos \, \frac{2\pi ki}{32} + B_k \, Sin \, \frac{2\pi ki}{32} \right]$$

$$Y_1 = A_o + \sum_{k=1}^{16} C_x \, Sin \left[ \frac{2\pi ki}{32} + \phi_k \right]$$

$$\longrightarrow \quad A_k \, Cos \, \frac{2\pi ki}{32} + B_k \, Sin \, \frac{2\pi ki}{32} = C_k \, Sin \left[ \frac{2\pi ki}{32} + \phi_k \right]$$

$$= C_k \, Sin \, \frac{2\pi ki}{32} + Cos \, \phi_k + C_k \, Cos \, \frac{2\pi ki}{32} \, . \, Sin \, \phi_k$$

Sehingga

$$A_k = C_k \, \phi_k \quad \& \quad B_k = C_k \, Cos \, \phi_k$$

$$A_k^{\,2} + B_k^{\,2} = C_k^{\,2} \phi_k + \& \; C_k^{\,2} \, Cos^2 \phi_k$$

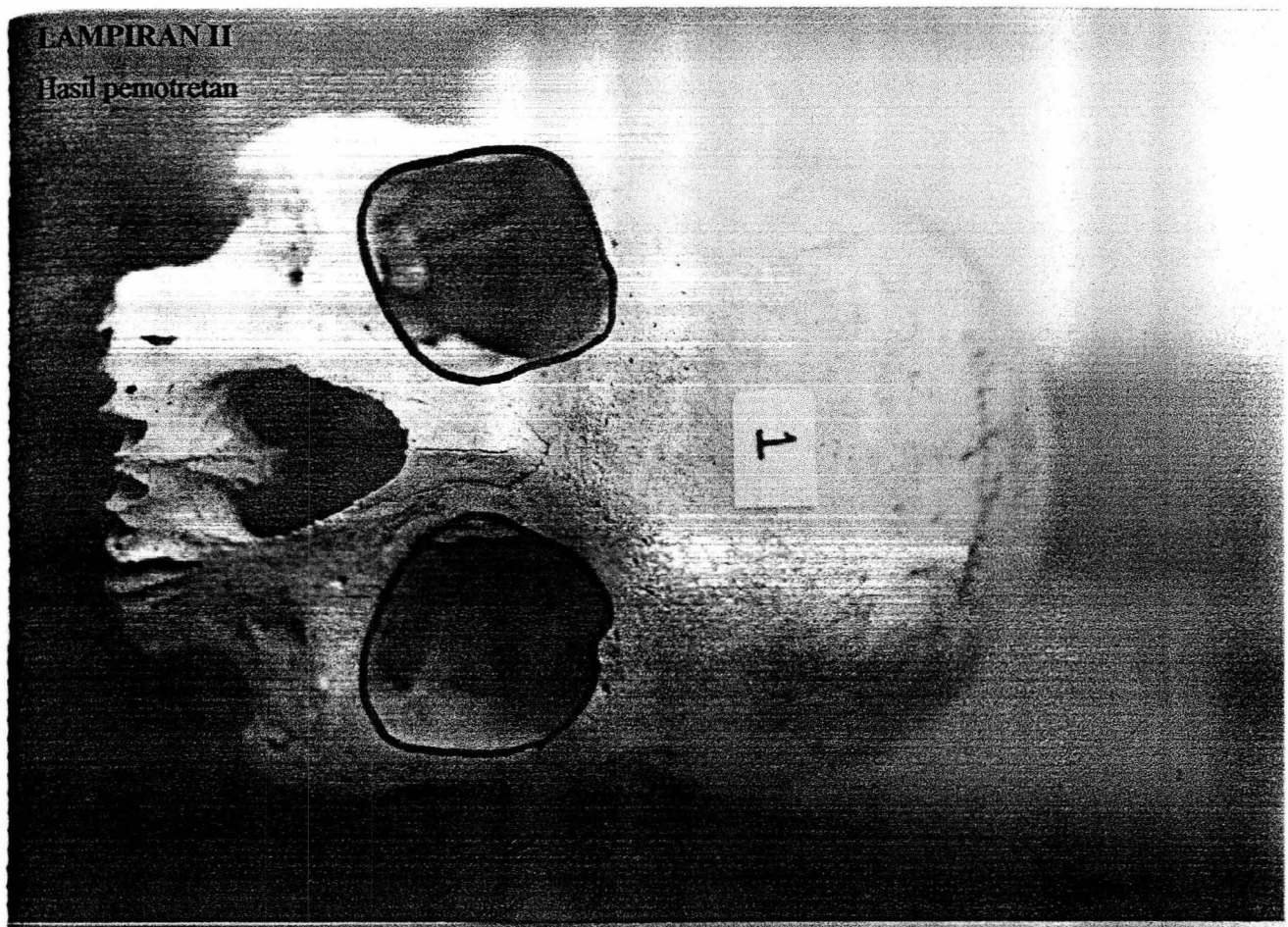
$$= C_k^{\,2} \left[ Cos^2 \phi_k + Sin^2 \phi_k \right] = C_k^{\,2}$$

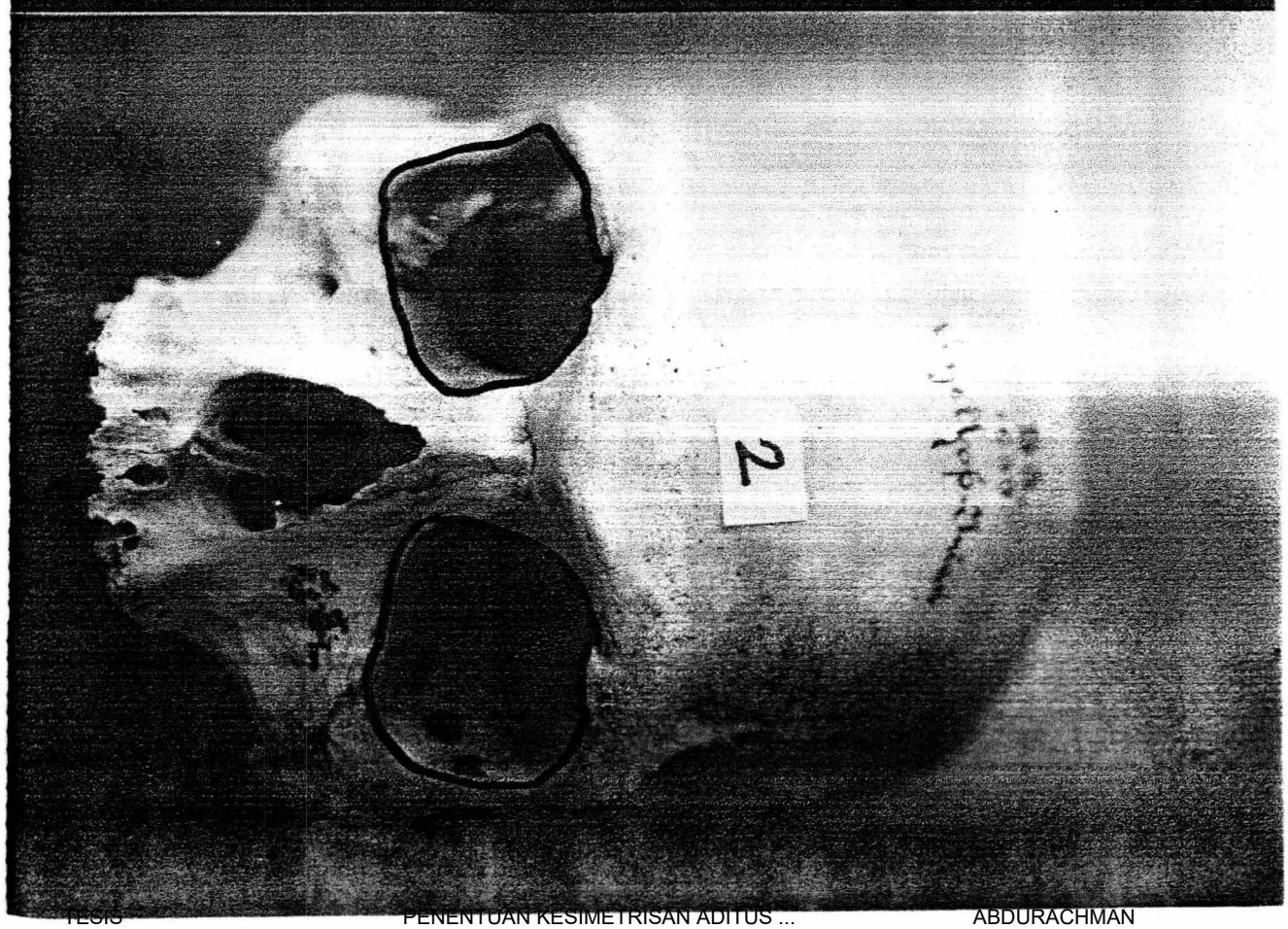
$$\boxed{C_k = \sqrt{A_k^{\,2} + B_k^{\,2}}}$$

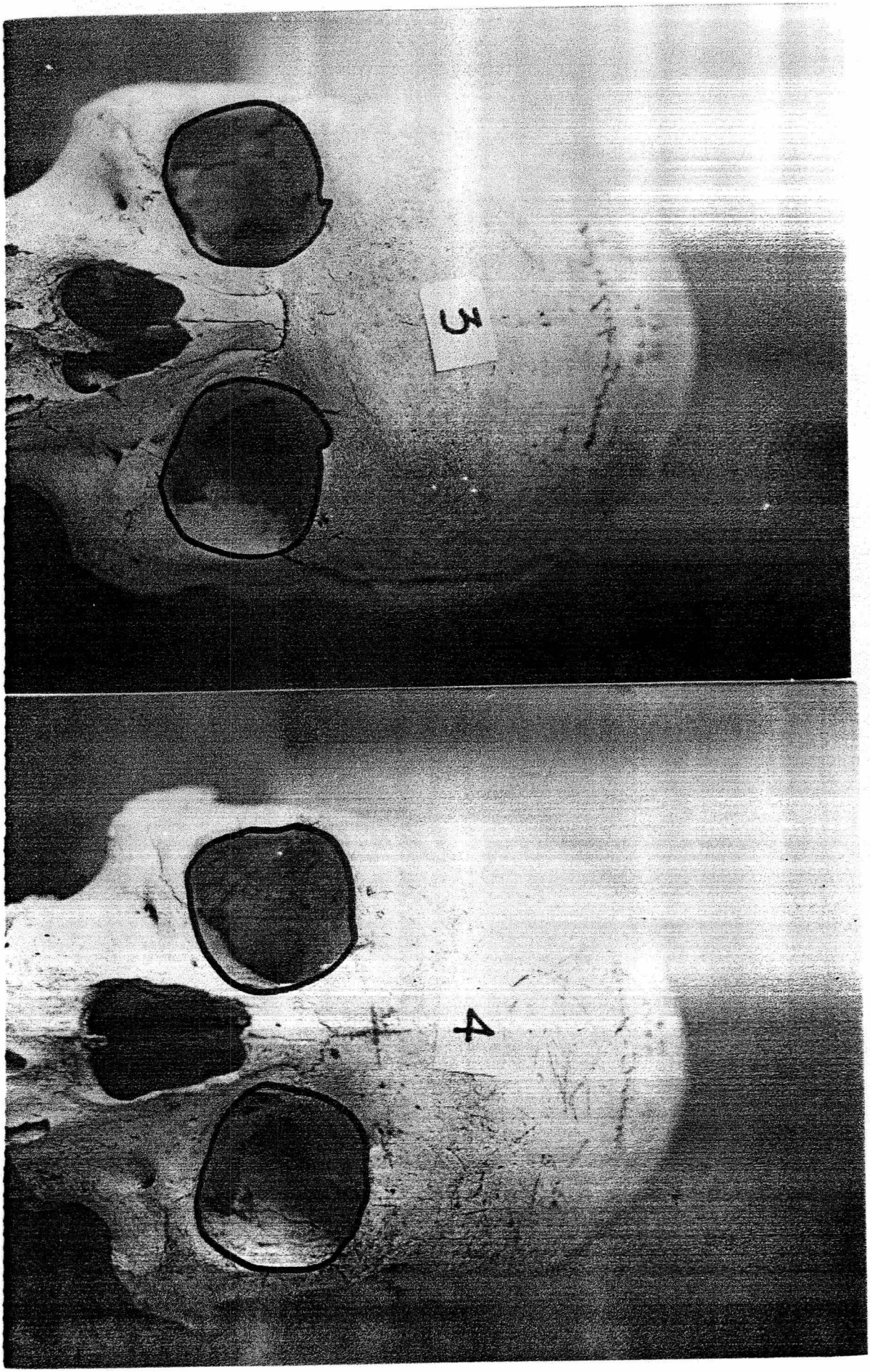
$$\frac{A_k}{B_k} = \frac{C_k \, Sin \, \phi_k}{C_k \, Cos \, \phi_k} = tg \, \phi_k \longrightarrow \boxed{\phi_k = tg^{-1} \left[ \frac{A_k}{B_k} \right]}$$

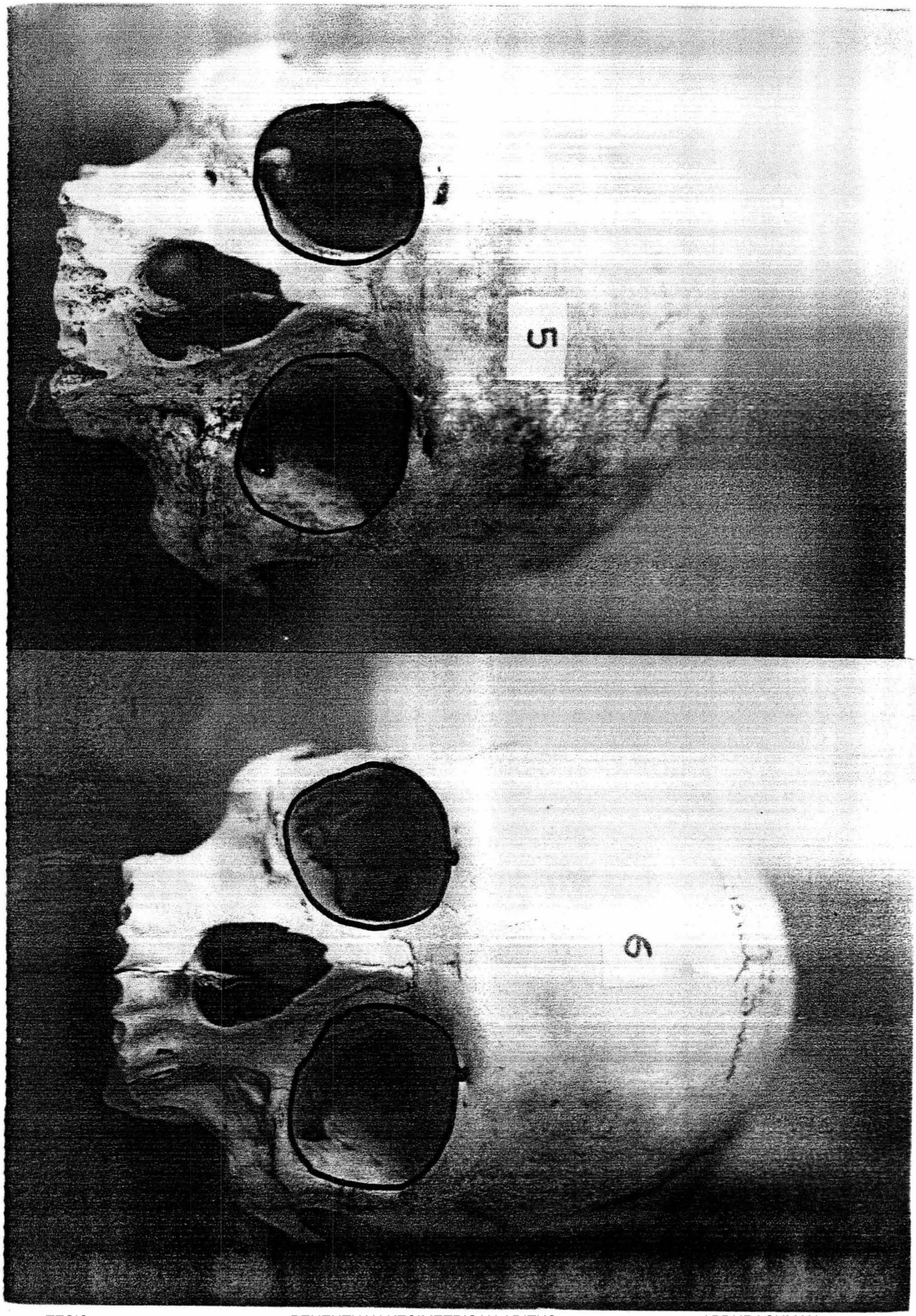
**LAMPIRAN II**

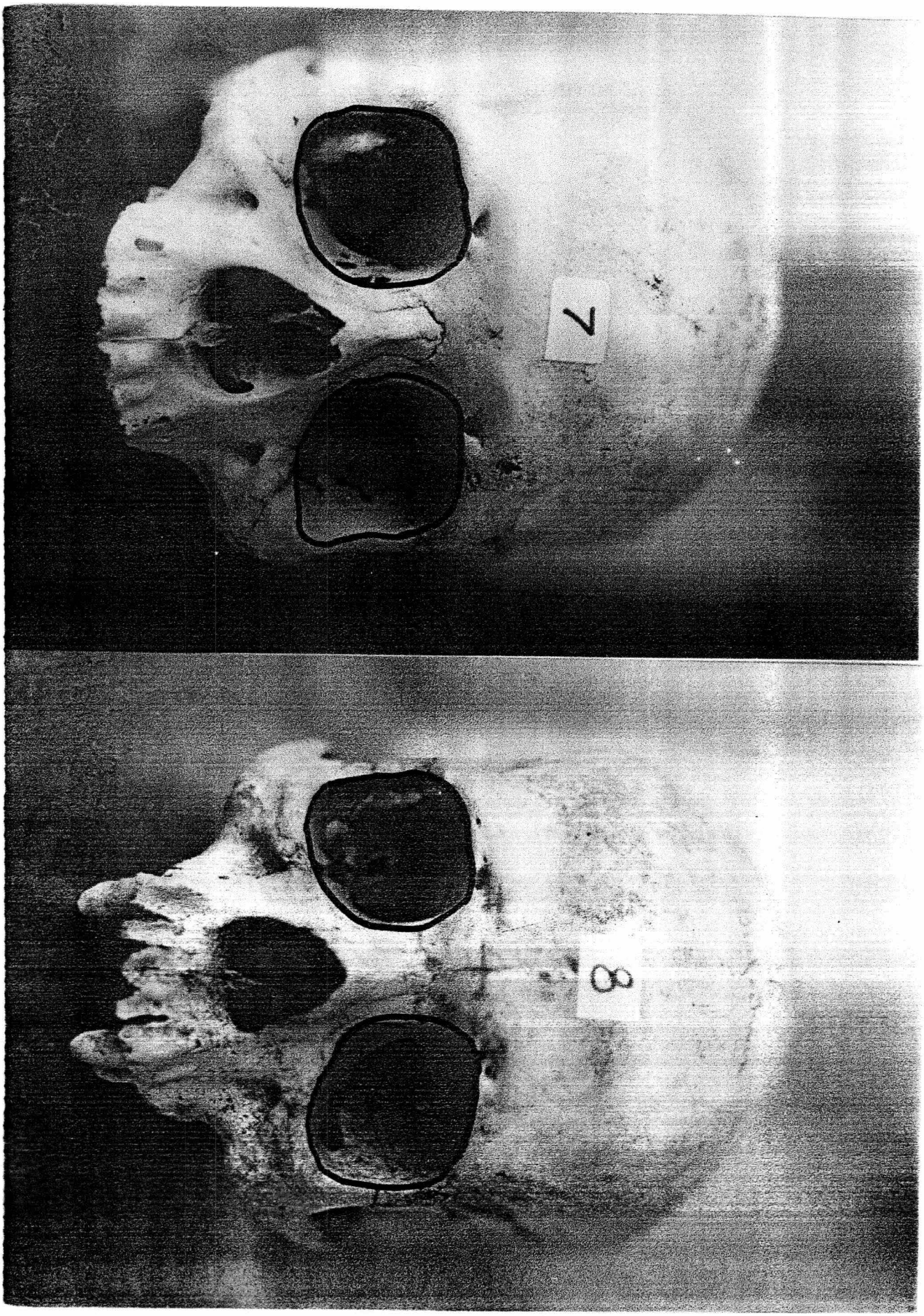
**Hasil pemotretan**

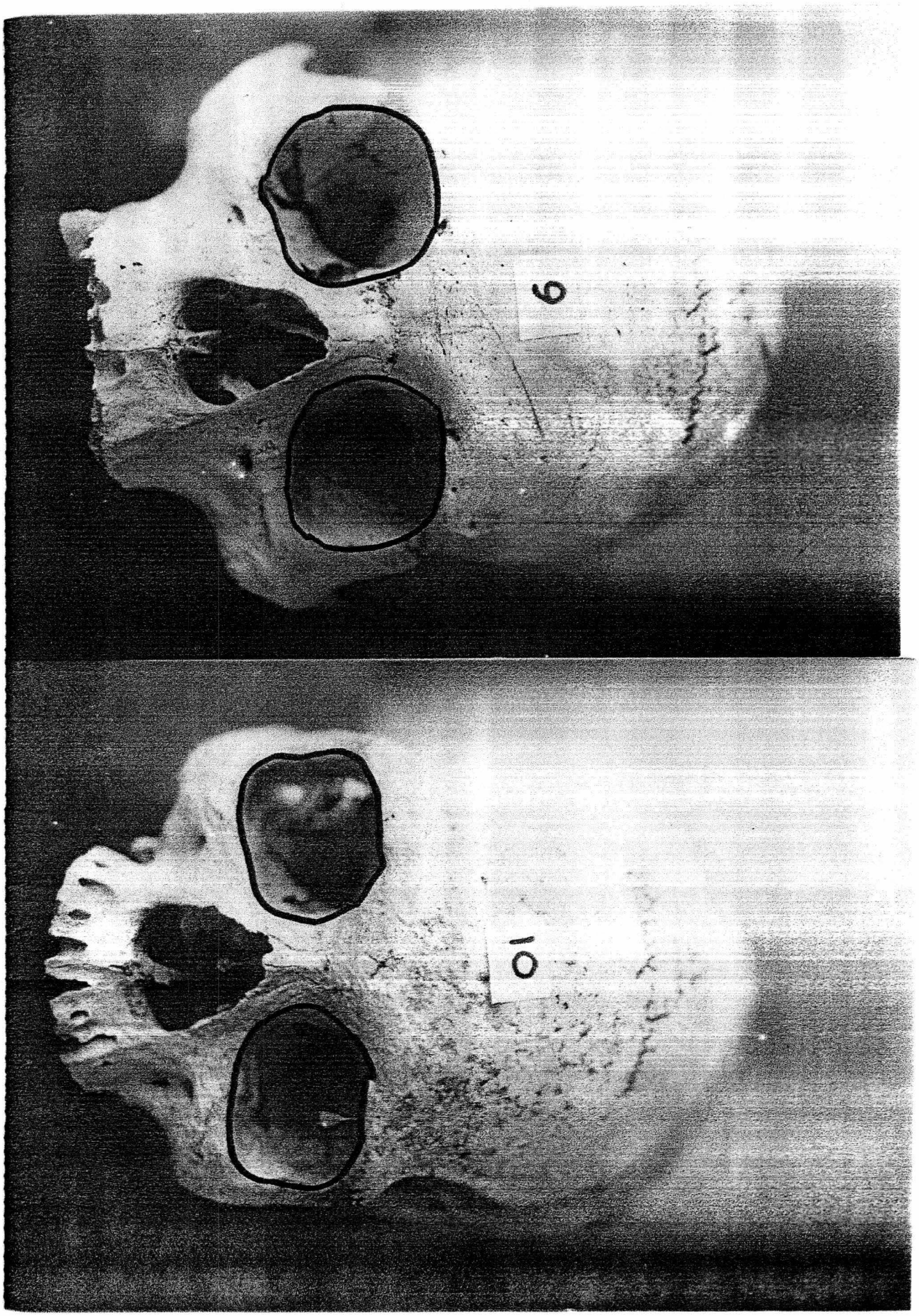






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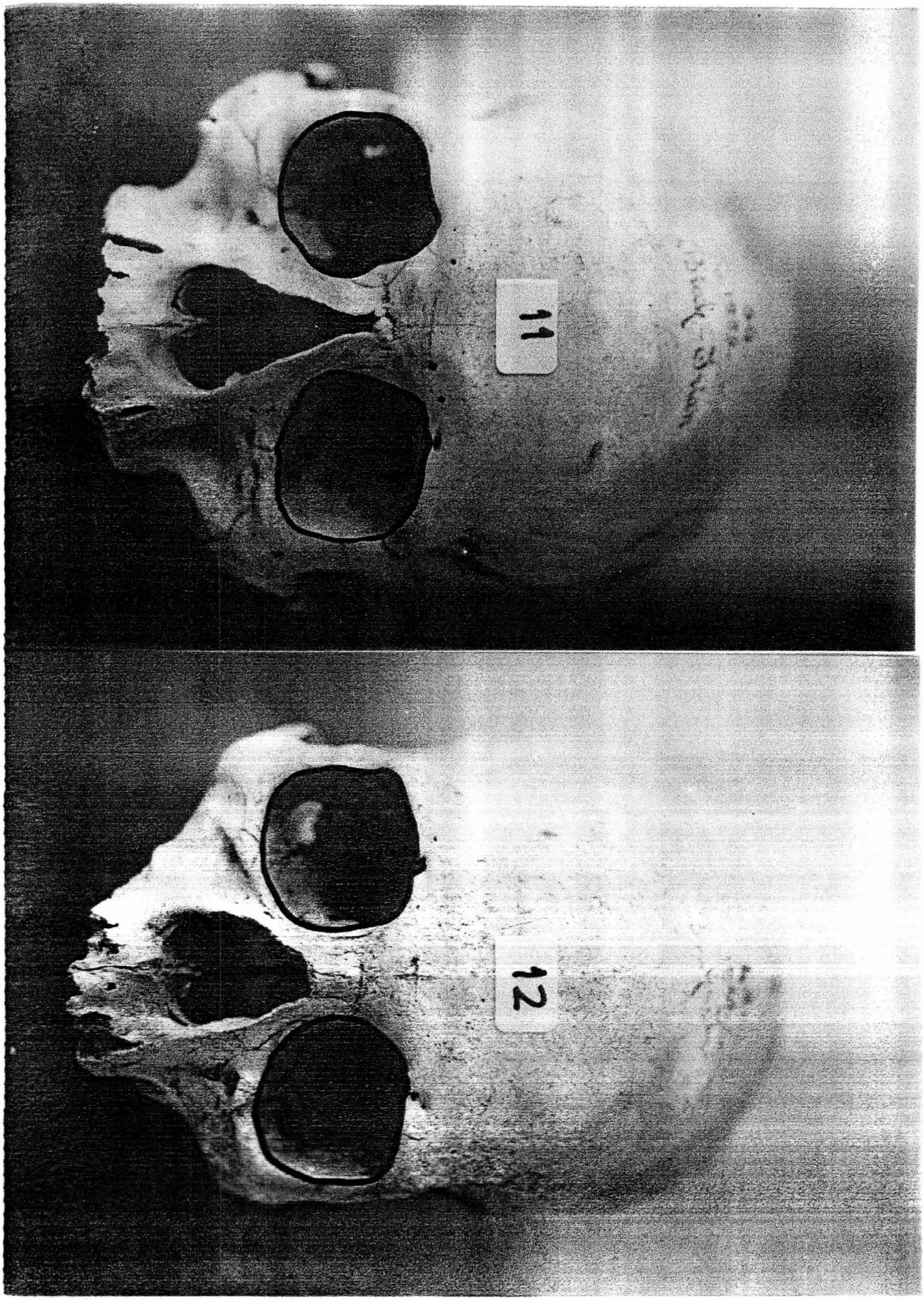
10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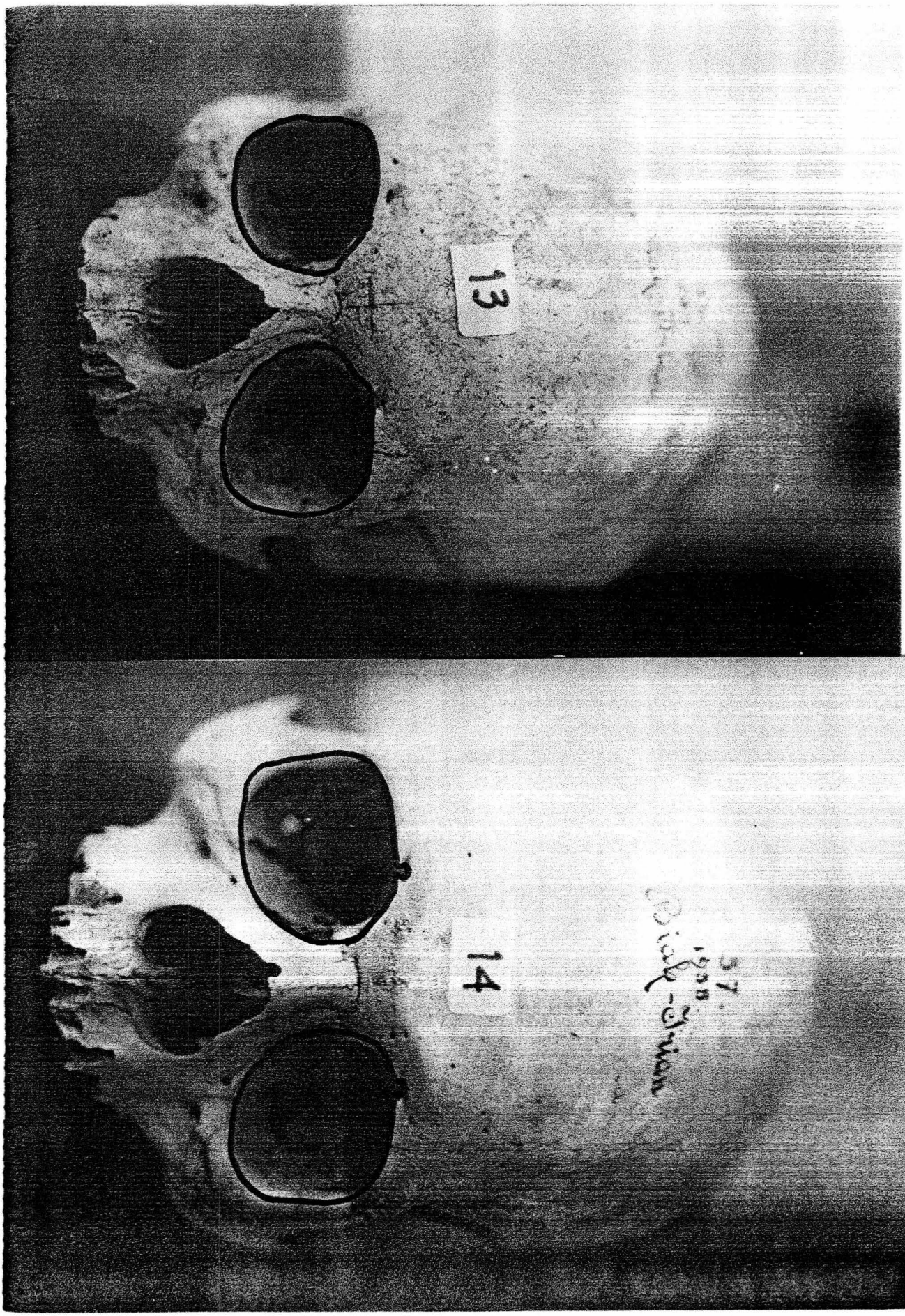
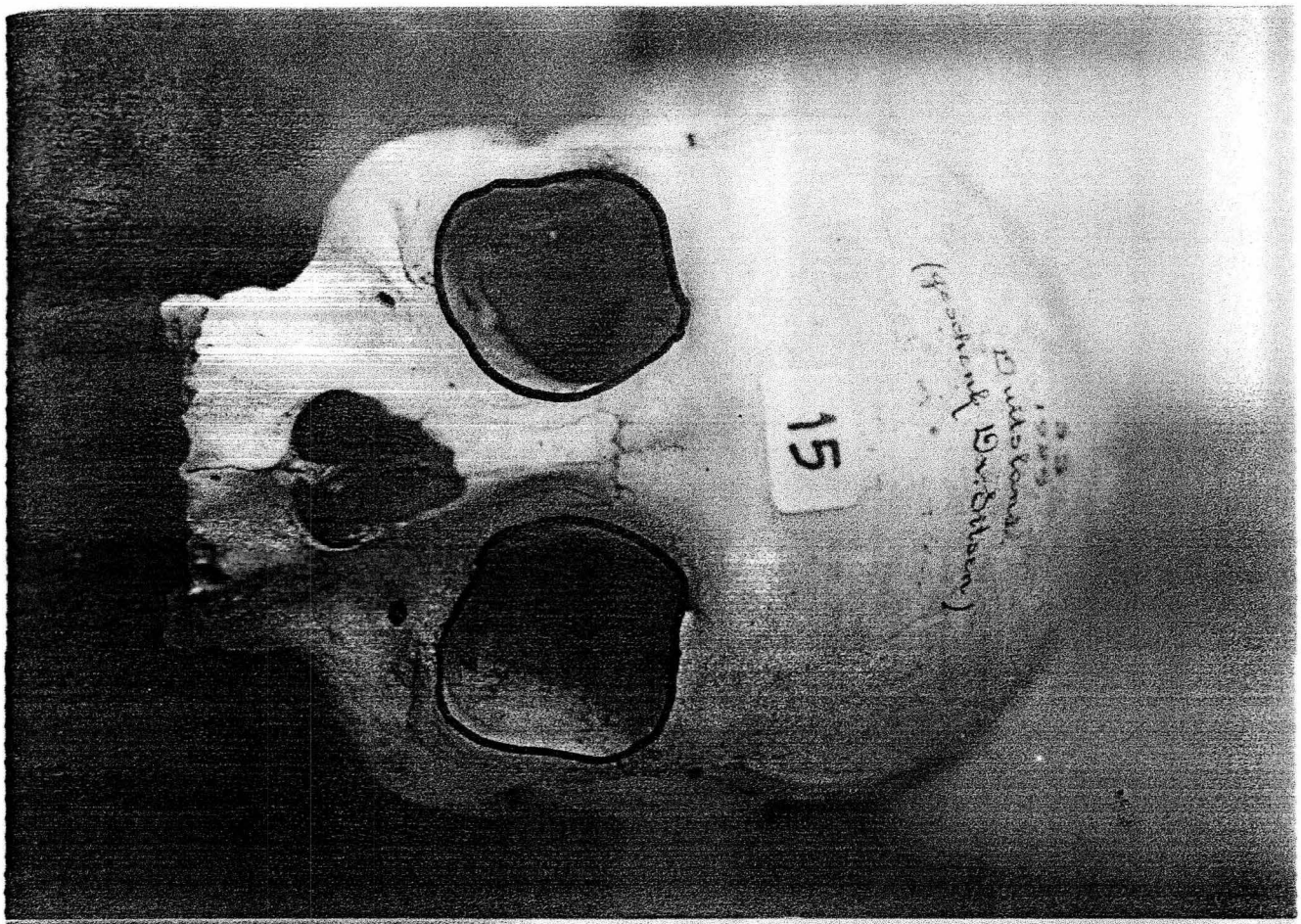
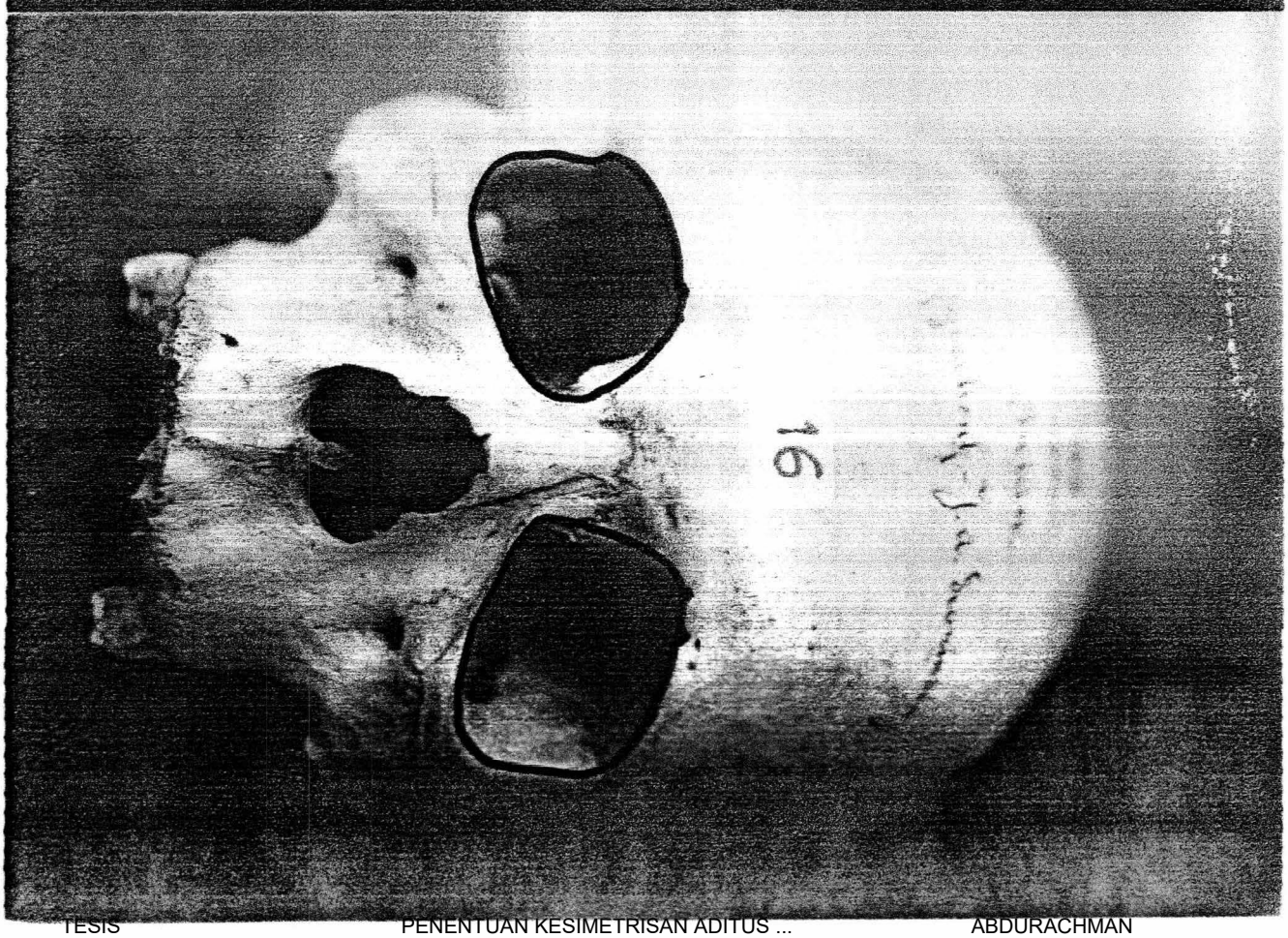
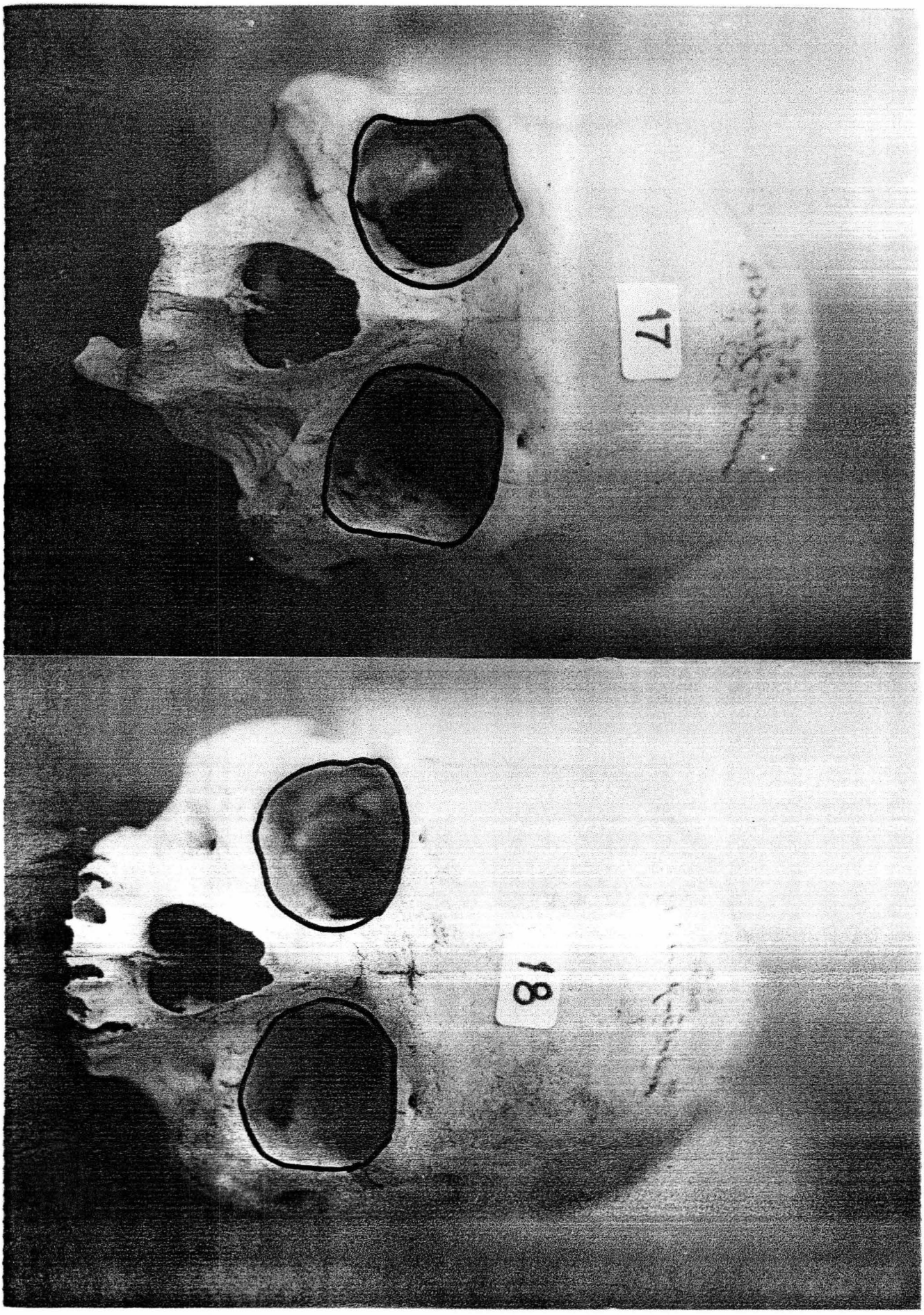
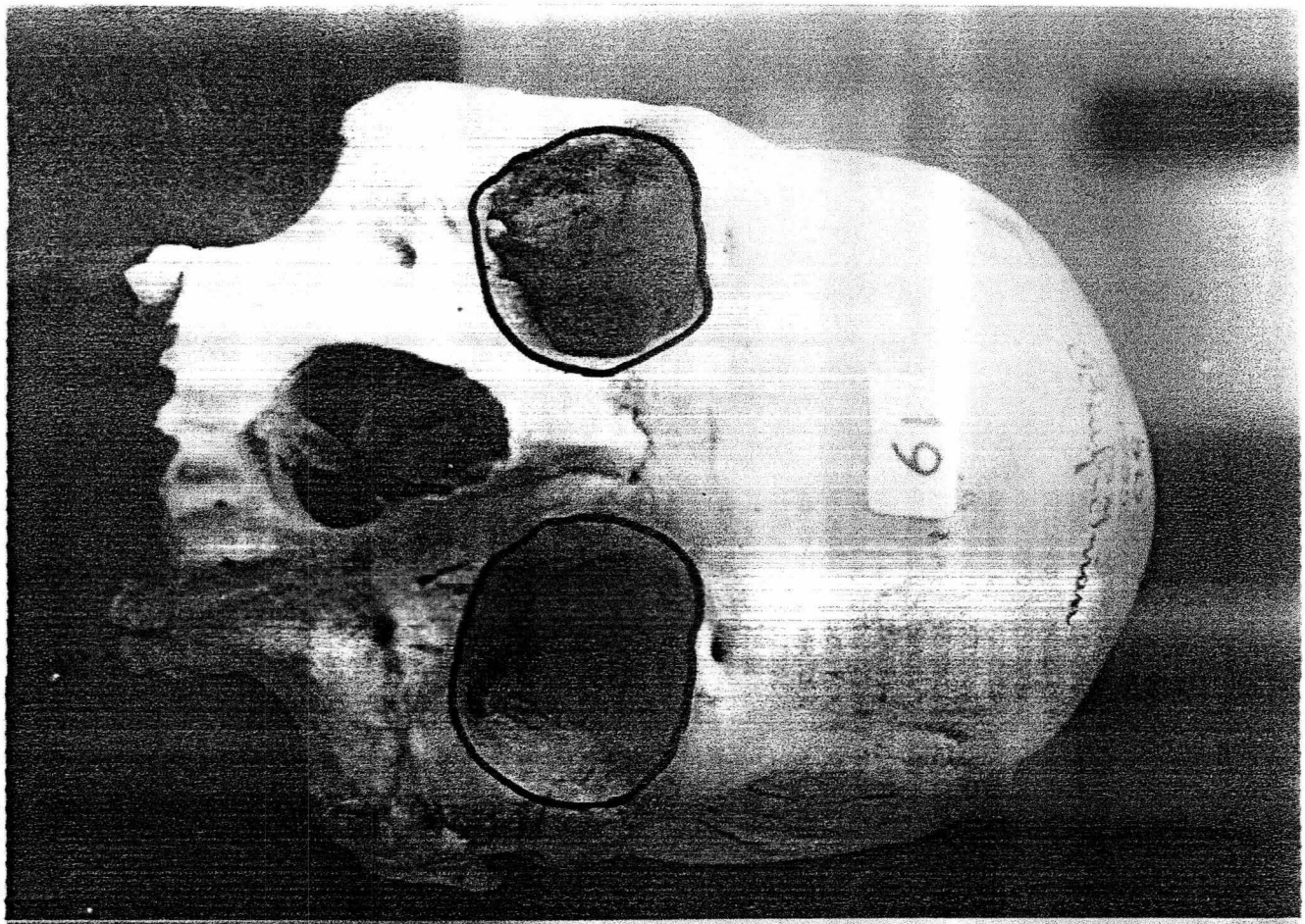
12

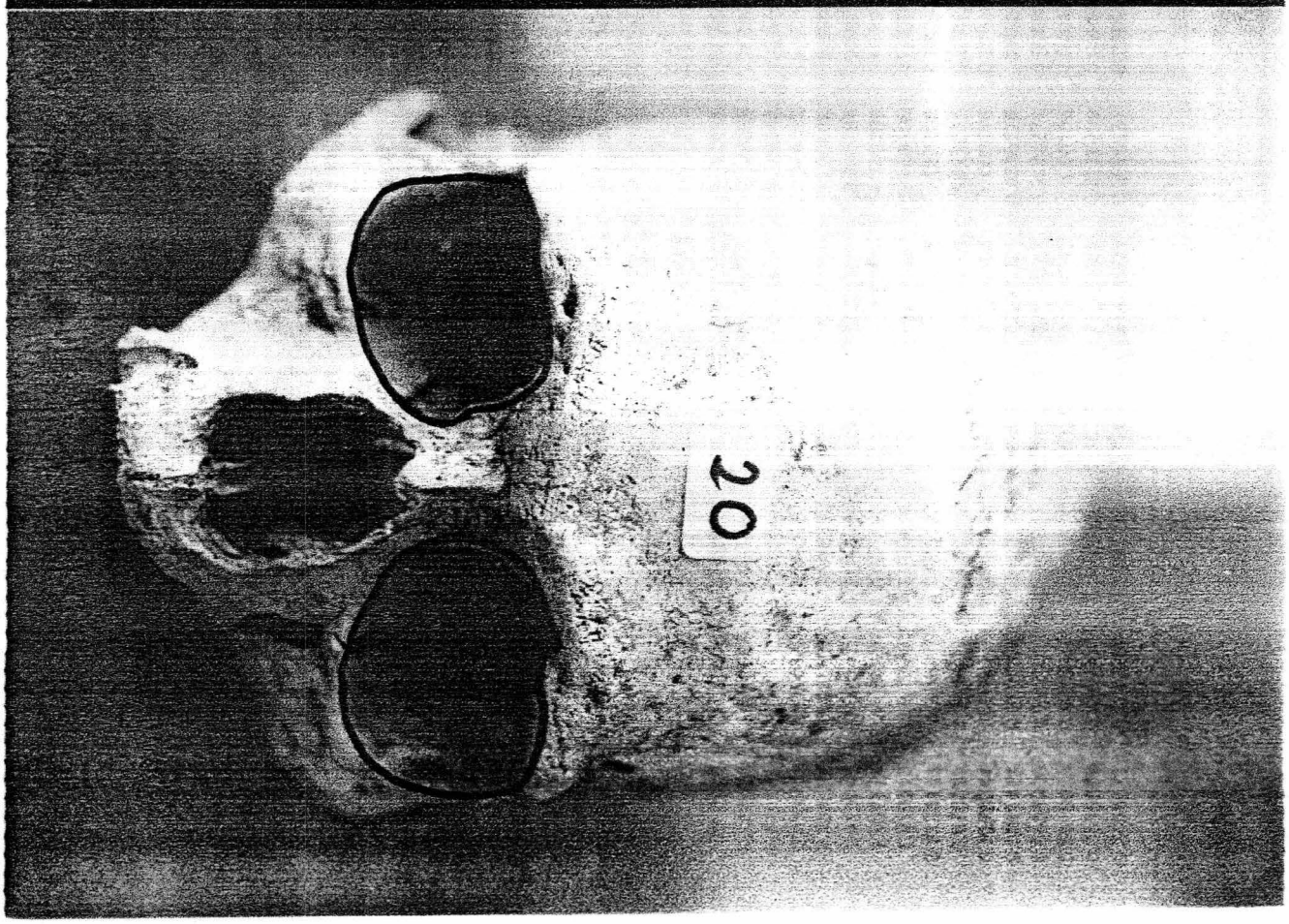

13
14






19


20

# LAMPIRAN III

Hasil analisis Fourier pada *aditus orbita*

*Hasil analisis Fourier quadran a kanan (Gambar 4.6.) untuk tengkorak 1 - 10*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 56.02347 | 37.51702 | 65.27911 | 61.33829 | 61.33829 | 58.43287 | 62.45692 | 61.83319 | 49.84547 | 49.84547 |
| 17.91647 | 23.06035 | 18.82646 | 16.84405 | 16.84405 | 17.3969 | 12.82297 | 14.54046 | 16.12338 | 16.12338 |
| 6.874219 | 10.65774 | 4.132313 | 6.618904 | 6.618904 | 8.858022 | 6.933339 | 7.490789 | 8.522701 | 8.522701 |
| 4.887209 | 9.187189 | 2.696455 | 3.761823 | 3.761823 | 5.053307 | 3.369387 | 3.939819 | 5.731492 | 5.731492 |
| 3.120941 | 4.780472 | 4.669675 | 2.527483 | 2.527483 | 2.829471 | 2.928729 | 3.382831 | 2.737517 | 2.737517 |
| 3.170178 | 3.294989 | 3.616949 | 2.877679 | 2.877679 | 2.604455 | 2.491733 | 1.126593 | 3.446124 | 3.446124 |
| 2.06834 | 2.470041 | 0.8898619 | 1.412395 | 1.412395 | 2.368382 | 1.434593 | 1.038809 | 3.051116 | 3.051116 |
| 1.119864 | 1.733068 | 0.8242852 | 0.7067006 | 0.7067006 | 1.571944 | 1.397471 | 1.368291 | 2.377375 | 2.377375 |
| 1.156485 | 1.751097 | 1.595513 | 0.8045918 | 0.8045918 | 0.8306891 | 1.526393 | 1.117693 | 1.935233 | 1.935233 |
| 1.144633 | 2.142064 | 1.456917 | 0.8473318 | 0.8473318 | 1.057581 | 1.231296 | 1.248569 | 1.378031 | 1.378031 |
| 0.8288425 | 1.962508 | 0.5429463 | 0.5356536 | 0.5356536 | 0.9121229 | 1.111977 | 0.8912702 | 1.354728 | 1.354728 |
| 1.004802 | 2.039394 | 0.403768 | 0.3603392 | 0.3603392 | 1.031266 | 0.9894669 | 0.7689708 | 1.386594 | 1.386594 |
| 0.6594545 | 1.839938 | 0.6993128 | 0.598536 | 0.598536 | 0.9543501 | 0.8772259 | 0.6118746 | 1.136172 | 1.136172 |
| 0.5068931 | 1.439249 | 0.4858108 | 0.6374711 | 0.6374711 | 0.9737564 | 1.015591 | 0.7082905 | 1.041442 | 1.041442 |
| 0.5630433 | 1.239985 | 0.7841415 | 0.5453755 | 0.5453755 | 1.144706 | 0.657073 | 0.714511 | 1.00416 | 1.00416 |
| -0.2032017 | -0.5484226 | -0.3399021 | -9.01E-02 | -9.01E-02 | -0.6085412 | -0.5371997 | -0.4971884 | -0.4465037 | -0.4465037 |

*Hasil analisis Fourier quadran b (Gambar 4.6.) kanan untuk tengkorak 1 - 10*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 67.2674 | 74.33068 | 61.65064 | 58.12022 | 56.6123 | 53.37968 | 66.46878 | 58.25337 | 70.1857 | 64.79126 |
| 12.99826 | 21.9829 | 15.57165 | 15.09478 | 17.66174 | 17.28206 | 14.65174 | 16.92572 | 13.98441 | 19.83921 |
| 5.594188 | 4.303157 | 7.516564 | 6.683398 | 9.098954 | 8.099319 | 6.55819 | 6.428577 | 5.204583 | 7.670951 |
| 3.988674 | 2.666638 | 5.002963 | 5.249146 | 4.581198 | 5.044082 | 3.428855 | 4.556423 | 2.837399 | 3.549767 |
| 2.365378 | 1.537161 | 3.016353 | 3.288472 | 2.677058 | 3.80474 | 2.695858 | 3.508542 | 1.741621 | 1.901668 |
| 1.418044 | 2.220725 | 2.613544 | 1.021681 | 2.223313 | 2.100754 | 0.655739 | 1.762185 | 0.4523951 | 1.731721 |
| 1.937778 | 1.41307 | 0.541568 | 1.189988 | 2.0472 | 1.765709 | 1.172786 | 2.041134 | 2.134134 | 1.816071 |
| 1.019218 | 0.7436918 | 1.009804 | 0.5898293 | 1.351238 | 1.453136 | 1.309127 | 1.941658 | 1.030692 | 0.8890512 |
| 0.9133111 | 0.485397 | 1.085197 | 0.5058443 | 0.7199472 | 1.253498 | 0.5669001 | 1.066984 | 0.7780026 | 0.4955151 |
| 0.976258 | 0.9154372 | 0.8067297 | 0.7793475 | 0.380748 | 1.429235 | 0.8281011 | 0.9034516 | 0.8662022 | 0.4844181 |
| 0.5176241 | 1.048165 | 0.9084606 | 0.6706613 | 0.5301184 | 1.000048 | 0.6754445 | 0.7807147 | 0.6342359 | 0.8374552 |
| 0.5911871 | 0.9322899 | 0.9113478 | 0.7471734 | 0.6989921 | 0.9655126 | 0.638103 | 0.6636466 | 0.4903537 | 0.8278038 |
| 0.6486026 | 0.3737786 | 0.9320846 | 0.5318731 | 0.4945742 | 0.9574271 | 0.2935632 | 0.6108005 | 0.8192126 | 0.530129 |
| 0.5516608 | 0.1755033 | 0.5601813 | 0.4221581 | 0.7111741 | 1.00104 | 0.6404458 | 0.7741045 | 0.338631 | 0.3279873 |
| 0.3851869 | 0.4659415 | 0.5453552 | 0.1038556 | 0.5930469 | 0.8938199 | 0.3299949 | 0.4131587 | 0.3927881 | 0.551377 |
| -0.2458473 | -0.2723208 | -0.363146 | -0.1262395 | -0.3066626 | -0.5888931 | -0.2858975 | -0.2367859 | -0.2889505 | -0.3154076 |

Hasil analisis Fourier quadran a kanan (Gambar 4.6.) untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 57.23057 | 67.42422 | 68.20588 | 54.95964 | 70.01631 | 66.5412 | 45.58916 | 65.84409 | 77.881 | 63.66418 |
| 16.70078 | 16.66395 | 8.819748 | 13.70181 | 15.79541 | 13.38036 | 21.7337 | 12.92186 | 10.97326 | 16.71693 |
| 6.821847 | 5.15886 | 6.80737 | 8.522558 | 6.853057 | 5.601211 | 13.29475 | 6.861999 | 4.442075 | 7.327871 |
| 3.987254 | 3.160419 | 5.532114 | 5.061703 | 3.328864 | 3.198698 | 6.557554 | 4.016867 | 2.37409 | 4.028427 |
| 3.63599 | 2.058164 | 1.9198 | 3.854926 | 2.482179 | 3.414472 | 5.048869 | 2.142021 | 2.651324 | 2.294543 |
| 2.02801 | 1.92255 | 3.014903 | 1.98595 | 2.152345 | 2.036986 | 3.000157 | 2.351437 | 0.907742 | 2.520693 |
| 1.652278 | 1.537787 | 0.8034509 | 2.746269 | 1.535614 | 1.473056 | 2.167392 | 1.459601 | 1.473186 | 1.840083 |
| 2.078445 | 0.6934895 | 1.129129 | 1.792966 | 0.721015 | 1.30579 | 1.492818 | 0.7963691 | 0.9607577 | 0.740235 |
| 1.533551 | 0.713548 | 0.9105582 | 1.640519 | 1.445141 | 1.141682 | 1.508532 | 0.9813092 | 0.4273424 | 0.7834837 |
| 1.409422 | 0.8815461 | 0.5243038 | 1.354441 | 1.016558 | 0.8005631 | 1.634522 | 0.8991087 | 0.5366154 | 0.9443561 |
| 1.667272 | 0.4950959 | 0.9017244 | 1.201405 | 0.8841201 | 0.9084041 | 1.847785 | 0.7812741 | 0.442887 | 0.8304752 |
| 1.596197 | 0.4490358 | 0.3970121 | 1.002249 | 0.5887499 | 0.9435788 | 1.627728 | 0.8962706 | 0.5802233 | 0.8539532 |
| 1.199821 | 0.4362847 | 0.7392172 | 1.344456 | 0.6757346 | 0.5004665 | 1.251257 | 0.595112 | 0.3052544 | 0.5152123 |
| 1.480582 | 0.5944601 | 0.6594504 | 1.099034 | 0.679425 | 0.6994821 | 1.181558 | 0.7403676 | 0.6348483 | 0.515931 |
| 1.146695 | 0.3796624 | 0.488744 | 1.185544 | 0.717973 | 0.4759528 | 1.28 | 0.613767 | 0.1883595 | 0.5161863 |
| -0.564185 | -0.2339868 | -0.3553876 | -0.6071311 | -0.203863 | -0.3062422 | -0.6421048 | -0.3395189 | -0.2395062 | -0.1466399 |

Hasil analisis Fourier quadran b (Gambar 4.6.) kanan untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 63.55664 | 78.38566 | 65.91019 | 61.54705 | 61.1397 | 76.45248 | 76.55413 | 66.85503 | 67.20348 | 75.61585 |
| 15.04139 | 3.547561 | 15.03131 | 17.06517 | 14.75343 | 12.21704 | 13.14678 | 19.97259 | 15.1351 | 12.87405 |
| 7.235523 | 6.020247 | 6.830043 | 6.966099 | 7.676008 | 2.853679 | 2.804313 | 6.182333 | 6.272674 | 4.369531 |
| 3.754221 | 3.076005 | 3.93938 | 4.299216 | 4.686128 | 3.04213 | 2.828624 | 2.907166 | 2.829368 | 3.170093 |
| 3.314015 | 2.474486 | 2.273501 | 2.971987 | 2.769668 | 2.078049 | 1.924775 | 1.628237 | 1.952768 | 2.039918 |
| 2.050434 | 1.738582 | 2.105218 | 1.363807 | 2.42907 | 1.225997 | 1.356468 | 0.8025586 | 1.457381 | 1.269926 |
| 1.997441 | 1.226093 | 0.3141421 | 1.839317 | 0.5899961 | 1.35433 | 1.71965 | 0.7021535 | 0.5708506 | 0.6481693 |
| 1.198048 | 0.7388073 | 1.239612 | 1.987382 | 1.099706 | 1.397346 | 1.340361 | 1.098227 | 1.63377 | 0.5086656 |
| 0.9460574 | 1.290484 | 1.062528 | 1.393089 | 1.097084 | 0.4732386 | 0.3258252 | 0.4343833 | 0.6580948 | 1.297626 |
| 0.6044308 | 0.3995652 | 0.7660309 | 1.289234 | 0.96098 | 0.7874637 | 0.8765218 | 0.155855 | 0.6118559 | 0.7147462 |
| 0.3119487 | 0.9580596 | 0.558445 | 1.151888 | 0.8166968 | 0.3831826 | 0.6408696 | 0.7159161 | 0.6223386 | 0.5462051 |
| 0.6348416 | 0.3931075 | 0.500557 | 1.001737 | 0.8084433 | 0.5054211 | 0.4811269 | 0.543163 | 0.6507901 | 0.8803565 |
| 0.4394633 | 0.7191756 | 0.5249232 | 0.9373623 | 0.748705 | 0.5962838 | 0.6841495 | 0.2761612 | 0.5238623 | 0.3480814 |
| 0.6044888 | 0.4056665 | 0.3150528 | 1.151529 | 0.4038797 | 0.4292673 | 0.3091724 | 0.5266693 | 0.475929 | 0.3859403 |
| 0.4930031 | 0.4307107 | 0.5844922 | 0.985723 | 0.5105156 | 0.1757746 | 0.465669 | 0.4873155 | 0.751583 | 0.3489083 |
| -0.3826271 | -0.1901138 | -0.3374507 | -0.495921 | -0.2747973 | -0.2718834 | -0.2671884 | -0.1533778 | -0.1749226 | -0.2541611 |

*Hasil analisis Fourier quadran c (Gambar 4.6.) kanan untuk tengkorak 1 - 10*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 53.33731 | 73.49201 | 61.00846 | 53.96573 | 63.64559 | 58.00739 | 59.68276 | 59.88786 | 51.6877 | 59.38878 |
| 18.74656 | 9.70957 | 15.17337 | 18.35482 | 16.74304 | 15.02041 | 15.63883 | 15.80382 | 15.79354 | 17.29689 |
| 10.41224 | 4.899947 | 8.399554 | 8.74775 | 6.711581 | 8.457359 | 6.000668 | 6.71911 | 8.634127 | 8.553547 |
| 5.796381 | 2.545408 | 4.048021 | 4.842906 | 3.531904 | 6.253463 | 4.695609 | 4.298836 | 6.144811 | 4.357857 |
| 3.560684 | 2.581903 | 3.600491 | 3.012395 | 2.174936 | 4.347933 | 3.269791 | 3.00245 | 4.368556 | 2.473813 |
| 1.60773 | 2.197554 | 2.657004 | 2.352476 | 1.778085 | 2.895289 | 2.12497 | 2.502126 | 2.989261 | 1.520209 |
| 1.672407 | 0.8581767 | 2.140661 | 1.599571 | 1.376669 | 2.774029 | 1.716373 | 1.357774 | 2.478313 | 0.8866434 |
| 0.9687334 | 1.46468 | 1.666126 | 1.592403 | 0.4300165 | 1.934489 | 1.926811 | 1.649585 | 1.53686 | 0.8570582 |
| 1.288581 | 1.09895 | 1.145591 | 1.596168 | 1.202325 | 0.9979608 | 1.218162 | 1.035522 | 1.661502 | 1.160528 |
| 0.9874819 | 1.014908 | 0.8753939 | 1.369284 | 0.8541041 | 1.150224 | 0.9359472 | 1.006138 | 1.282318 | 1.531374 |
| 0.7748637 | 0.4829182 | 0.7125452 | 1.073161 | 0.6898083 | 1.05154 | 1.139708 | 0.7417426 | 1.018996 | 1.085403 |
| 0.4578461 | 0.6950376 | 0.8980766 | 1.001552 | 0.5878646 | 1.060427 | 0.8012837 | 0.8324052 | 1.278742 | 0.7376651 |
| 0.6382258 | 0.7432414 | 0.8601412 | 1.000587 | 0.5469051 | 1.173643 | 0.6646123 | 1.005202 | 1.041225 | 0.6623431 |
| 0.7707563 | 0.5379238 | 0.8364434 | 1.04105 | 0.5257513 | 1.244746 | 0.8423221 | 0.6835981 | 1.079625 | 0.8355964 |
| 0.9430735 | 0.659215 | 0.7206577 | 0.953767 | 0.5679895 | 1.19508 | 0.6409557 | 0.8422359 | 0.9466087 | 0.6390143 |
| -0.388314 | -0.4016907 | -0.5209354 | -0.5024202 | -0.1375048 | -0.7278318 | -0.3000374 | -0.3355268 | -0.489321 | -0.4134363 |

Hasil analisis Fourier quadran d (Gambar 4.6.) kanan untuk tengkorak 1 - 10

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 57.36195 | 66.33506 | 67.86601 | 57.12096 | 57.45705 | 63.26757 | 60.55738 | 56.16461 | 69.02168 | 67.51143 |
| 18.89129 | 14.84772 | 9.1785 | 16.83562 | 18.61239 | 12.4531 | 15.23349 | 14.88157 | 14.12387 | 12.80154 |
| 9.001432 | 7.235449 | 4.172891 | 7.517536 | 6.949446 | 6.462469 | 6.877958 | 7.553583 | 5.435168 | 6.919817 |
| 5.35291 | 4.433248 | 3.192266 | 4.365057 | 4.04849 | 3.803043 | 4.390581 | 4.631571 | 3.708357 | 4.051222 |
| 3.706007 | 2.595317 | 3.036794 | 3.160429 | 2.791068 | 3.238293 | 3.18212 | 3.751702 | 2.814454 | 2.719484 |
| 2.357562 | 2.211357 | 1.932008 | 2.582327 | 1.907789 | 1.883074 | 0.7929061 | 3.053884 | 2.161522 | 2.020511 |
| 1.481079 | 2.586467 | 1.163213 | 2.146105 | 1.74428 | 1.12925 | 1.911988 | 1.764299 | 1.56933 | 1.792336 |
| 2.225391 | 0.9515774 | 2.445336 | 1.772837 | 0.6762306 | 1.839628 | 1.495418 | 2.16367 | 1.139564 | 1.277976 |
| 1.833245 | 0.8562769 | 1.03536 | 1.384439 | 1.06243 | 1.14809 | 1.264511 | 1.81207 | 1.550177 | 1.599994 |
| 1.549017 | 1.007156 | 1.333815 | 1.086129 | 1.262181 | 1.198537 | 1.211523 | 1.27883 | 0.8652156 | 1.228462 |
| 1.352325 | 1.208001 | 1.259449 | 0.8439809 | 0.9081086 | 1.124967 | 1.126559 | 0.8864149 | 0.8158542 | 1.174922 |
| 1.380602 | 0.944525 | 1.222824 | 0.7036198 | 0.6089005 | 1.078966 | 0.6067535 | 0.8291922 | 0.6883388 | 1.10553 |
| 1.236585 | 0.8873531 | 1.013268 | 0.5149173 | 0.7464255 | 0.8801569 | 0.8891006 | 0.6738005 | 0.5650465 | 1.068473 |
| 1.02172 | 0.5960676 | 1.093675 | 0.6914815 | 0.678184 | 0.9514771 | 0.7351831 | 0.4247977 | 0.5000726 | 1.040643 |
| 1.314691 | 0.9690601 | 1.331546 | 0.5279843 | 0.6561594 | 1.066502 | 0.8438983 | 0.4998277 | 0.4779239 | 1.13126 |
| -0.6270398 | -0.5033843 | -0.3395504 | -0.1548866 | -0.2417773 | -0.4055375 | -0.4396867 | -0.30432 | -0.2083273 | -0.4648909 |

*Hasil analisis* Fourier quadran c (Gambar 4.6.) kanan untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 60.97814 | 61.37302 | 60.12209 | 71.24166 | 58.43364 | 61.81365 | 67.99244 | 58.01162 | 68.01647 | 54.28282 |
| 16.75915 | 16.56805 | 15.86638 | 11.87743 | 15.75995 | 15.07498 | 23.80995 | 16.1655 | 21.67238 | 18.80467 |
| 7.352604 | 7.537487 | 6.775228 | 3.891501 | 8.372216 | 8.743699 | 9.303912 | 8.009804 | 4.58268 | 8.985029 |
| 4.404523 | 3.962242 | 4.70628 | 4.165792 | 4.973397 | 5.049604 | 1.682371 | 4.93065 | 4.221317 | 4.668867 |
| 2.658614 | 3.176159 | 3.079402 | 2.077208 | 3.010993 | 3.04508 | 2.255063 | 2.271721 | 1.527016 | 3.237285 |
| 1.56941 | 2.389292 | 1.555892 | 1.744248 | 1.849168 | 2.685644 | 2.797962 | 2.88308 | 2.115468 | 2.107823 |
| 1.958078 | 1.429134 | 1.904289 | 1.630028 | 2.240668 | 1.629506 | 2.296405 | 1.205794 | 1.697592 | 1.986684 |
| 1.215589 | 0.7941481 | 1.040794 | 0.4981419 | 1.034311 | 1.675339 | 1.825032 | 0.9438438 | 0.2576451 | 1.028236 |
| 0.5700978 | 1.0477 | 0.5495808 | 1.295664 | 1.291066 | 1.064323 | 0.7489578 | 1.045847 | 0.7805815 | 0.6956941 |
| 0.5281026 | 0.6314566 | 0.824372 | 0.7727473 | 0.9586939 | 1.00768 | 0.343968 | 0.872578 | 1.133019 | 0.8145928 |
| 0.3856214 | 0.3370849 | 0.7736439 | 0.5485025 | 0.6763905 | 0.9076418 | 0.7508951 | 1.18284 | 0.5456609 | 0.9419998 |
| 0.5630538 | 0.7134684 | 0.844523 | 0.7630559 | 0.5082319 | 0.7052873 | 0.834164 | 0.7249738 | 0.6527343 | 0.9498876 |
| 0.4504867 | 0.547021 | 0.6934685 | 0.5519981 | 0.628385 | 0.7081849 | 0.8302746 | 0.791263 | 0.4146234 | 0.751422 |
| 0.5712102 | 0.6084796 | 0.673046 | 0.5030039 | 0.5215311 | 0.6678827 | 0.9018514 | 0.7434626 | 0.6342038 | 0.7608846 |
| 0.4107722 | 0.4701258 | 0.5506043 | 0.6372492 | 0.5459338 | 0.6115072 | 0.6052108 | 0.5547933 | 0.5637518 | 0.5979098 |
| -0.2524513 | -0.3310482 | -0.3720093 | -0.2069667 | -0.174238 | -0.23443 | -0.1231046 | -0.3834468 | -0.155941 | 0.2804762 |

Hasil analisis Fourier quadran d (Gambar 4.6.) kanan untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 50.134 | 58.54307 | 57.10599 | 57.10599 | 67.31963 | 60.3912 | 60.2766 | 65.05969 | 57.61486 | 61.78662 |
| 16.42449 | 15.6357 | 18.7626 | 18.7626 | 15.58199 | 19.39937 | 15.91165 | 15.68132 | 16.26678 | 21.2911 |
| 10.53202 | 8.121453 | 7.308201 | 7.308201 | 5.492472 | 8.245648 | 7.238951 | 6.515541 | 7.339766 | 10.02352 |
| 5.61697 | 3.252031 | 4.09781 | 4.09781 | 3.167898 | 5.389624 | 4.280553 | 4.180703 | 4.651567 | 5.099503 |
| 4.063538 | 2.404873 | 2.605049 | 2.605049 | 2.087038 | 3.93353 | 2.774881 | 2.071325 | 2.636568 | 2.622764 |
| 2.805658 | 1.583273 | 2.571586 | 2.571586 | 1.781836 | 1.92651 | 1.894682 | 2.119969 | 2.931056 | 1.090341 |
| 2.462842 | 2.596635 | 1.019969 | 1.019969 | 1.63616 | 2.168805 | 1.102162 | 0.5106152 | 1.09395 | 1.24052 |
| 1.218649 | 1.292429 | 1.129052 | 1.129052 | 0.4988376 | 2.053547 | 1.701346 | 1.01296 | 0.8606206 | 1.009062 |
| 1.540788 | 1.14765 | 1.53157 | 1.53157 | 0.8102512 | 1.466002 | 1.146768 | 1.182232 | 1.088479 | 0.8228993 |
| 1.19389 | 0.9243138 | 1.100219 | 1.100219 | 0.894693 | 1.461501 | 1.061042 | 0.7165072 | 1.136416 | 0.3343253 |
| 1.180278 | 1.187 | 0.9417425 | 0.9417425 | 0.6316163 | 1.33409 | 0.9686916 | 0.7796127 | 1.199577 | 0.482574 |
| 1.117977 | 1.002139 | 0.740188 | 0.740188 | 0.7452989 | 1.074143 | 0.8421077 | 0.7784375 | 0.9021994 | 0.6095386 |
| 1.247995 | 1.138505 | 0.8708578 | 0.8708578 | 0.5274281 | 0.7047088 | 0.7644092 | 0.8164077 | 1.019064 | 0.6442639 |
| 1.099785 | 0.7132946 | 0.7734816 | 0.7734816 | 0.5782625 | 0.8257333 | 0.661858 | 0.4594401 | 0.9342035 | 0.654372 |
| 1.029333 | 0.9567837 | 0.6601425 | 0.6601425 | 0.4505424 | 0.7836734 | 0.7208921 | 0.459502 | 0.6602682 | 0.3671775 |
| -0.3400563 | -0.4285517 | -0.4210142 | -0.4210142 | -0.2127342 | -0.437134 | -0.4850921 | -0.3568933 | -0.2739831 | 6.33E-02 |

*Hasil analisis Fourier quadran a' (Gambar 4.6.) kiri untuk tengkorak 1 - 10*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 48.92822 | 58.88793 | 65.53033 | 62.66801 | 67.79948 | 62.59824 | 64.29886 | 67.51877 | 62.22583 | 66.63284 |
| 18.6695 | 15.15795 | 19.31266 | 14.96498 | 15.26353 | 14.44448 | 14.24637 | 12.78548 | 12.94912 | 18.5876 |
| 9.988766 | 6.795833 | 2.842287 | 6.070524 | 6.329306 | 7.161881 | 6.310753 | 6.167708 | 7.076415 | 6.417866 |
| 7.438156 | 5.973219 | 3.288895 | 4.552978 | 3.441859 | 3.881919 | 3.630336 | 4.438693 | 3.503533 | 1.833525 |
| 3.021131 | 4.205266 | 4.528785 | 2.817859 | 2.654025 | 2.86104 | 3.554193 | 2.935054 | 2.625196 | 1.840924 |
| 2.185901 | 2.688228 | 2.459749 | 2.045486 | 2.409603 | 2.44282 | 0.9624174 | 1.358611 | 2.308803 | 1.506046 |
| 1.882765 | 2.153979 | 1.219654 | 1.958817 | 2.101077 | 1.538539 | 1.340217 | 1.639077 | 1.92092 | 2.328273 |
| 1.351393 | 1.05026 | 1.285095 | 1.247415 | 1.247466 | 0.6751168 | 1.531615 | 1.278209 | 0.8699922 | 0.9894024 |
| 1.777674 | 0.5985254 | 1.776616 | 0.8780741 | 1.155046 | 0.9260333 | 1.059905 | 1.300808 | 1.574842 | 0.9112178 |
| 1.515918 | 0.795175 | 1.077269 | 0.8625428 | 0.6440643 | 1.093023 | 0.9604448 | 0.9227155 | 1.174272 | 0.9958782 |
| 1.20071 | 0.272617 | 0.3168207 | 0.537158 | 0.3478572 | 0.816541 | 1.071449 | 0.6122903 | 1.175518 | 1.036891 |
| 1.082363 | 0.4306712 | 0.9099306 | 0.6559165 | 0.4670608 | 0.8659438 | 0.7858711 | 0.6446555 | 0.8333825 | 0.6278516 |
| 0.682842 | 0.6412676 | 0.8458935 | 0.4732218 | 0.369968 | 0.6720392 | 0.4038745 | 0.5841461 | 0.9149912 | 0.7981829 |
| 0.7745222 | 0.7148883 | 0.8167993 | 0.6145754 | 0.4956489 | 0.9039165 | 0.8612014 | 0.6322623 | 0.9628117 | 0.4088346 |
| 0.7973871 | 0.735851 | 0.5833231 | 0.6057794 | 0.32489 | 0.641222 | 0.7111906 | 0.5490241 | 0.8813152 | 0.5522963 |
| -0.3306085 | -0.4376503 | -0.2532005 | -0.2852767 | -0.2347281 | -0.2049121 | -0.3475725 | -0.3201998 | -0.3406848 | -0.174556 |

Hasil analisis Fourier quadran b' (Gambar 4.6.) kiri untuk tengkorak 1 - 10

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 60.30976 | 60.12469 | 62.96649 | 56.82908 | 60.38941 | 63.27033 | 67.43321 | 65.0463 | 64.74036 | 62.15967 |
| 16.42404 | 22.22038 | 17.35558 | 17.08776 | 16.61832 | 16.47315 | 11.68587 | 14.29902 | 15.09557 | 18.28692 |
| 6.407104 | 9.347027 | 5.820845 | 7.83143 | 7.750262 | 6.729307 | 5.822666 | 6.626328 | 5.571642 | 7.718118 |
| 4.385273 | 3.917786 | 4.590674 | 3.362064 | 4.117604 | 3.473412 | 3.719347 | 3.648909 | 5.002457 | 4.016178 |
| 2.876279 | 1.824364 | 1.538493 | 2.765814 | 2.10011 | 2.532409 | 1.775926 | 2.431149 | 2.293433 | 2.806343 |
| 2.278728 | 0.8504581 | 2.384515 | 2.733468 | 2.482065 | 2.607643 | 1.916797 | 1.190848 | 2.369556 | 2.076943 |
| 1.838771 | 0.3080051 | 1.70123 | 2.655799 | 0.8035392 | 1.154494 | 1.627373 | 2.1228 | 1.172441 | 1.540718 |
| 1.226854 | 1.113588 | 0.5652816 | 1.990477 | 1.097503 | 1.453415 | 1.240084 | 1.273934 | 1.017429 | 0.7209096 |
| 1.121294 | 0.91259 | 1.06088 | 1.008129 | 1.291753 | 1.384527 | 0.9368519 | 0.7277413 | 0.9982357 | 1.428063 |
| 0.7228296 | 0.8308545 | 0.5912958 | 1.103905 | 1.108297 | 1.147736 | 0.9078542 | 0.8048871 | 0.7351356 | 1.24478 |
| 0.5180512 | 0.6202838 | 0.5339645 | 0.9978939 | 0.8594248 | 1.067514 | 0.6526076 | 0.4539498 | 0.5872883 | 0.8056891 |
| 0.8832707 | 0.4855991 | 0.5049262 | 1.115969 | 0.4050705 | 0.558557 | 0.9686959 | 0.647163 | 0.4338342 | 0.5170379 |
| 0.587901 | 0.3465413 | 0.2579363 | 0.9949645 | 0.5387634 | 0.8315375 | 0.5283626 | 0.5468203 | 0.5371208 | 0.3861891 |
| 0.690513 | 0.4674523 | 0.4620454 | 1.003057 | 0.557467 | 0.8783374 | 0.6623097 | 0.6444566 | 0.5174679 | 0.715233 |
| 0.779729 | 0.6117243 | 0.5501755 | 1.067554 | 0.545857 | 0.6286648 | 0.7948783 | 0.2976097 | 0.4643581 | 0.7029258 |
| -0.3364958 | -0.3044981 | -0.2056519 | -0.5728867 | -0.3143407 | -0.3592804 | -0.1995284 | -0.3238296 | -0.2941865 | -0.1740416 |

Hasil analisis Fourier quadran a' (Gambar 4.6.) kiri untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 62.44212 | 58.64192 | 70.40268 | 64.81469 | 74.40883 | 66.83046 | 61.3139 | 64.90714 | 68.27438 | 49.66966 |
| 19.65857 | 16.30949 | 11.69758 | 15.62922 | 6.944341 | 12.47546 | 15.15313 | 17.29441 | 13.11982 | 24.03599 |
| 4.739997 | 7.439503 | 6.868964 | 6.511133 | 5.96236 | 6.654786 | 6.61578 | 6.040581 | 6.26557 | 10.69659 |
| 3.726779 | 3.81061 | 3.376416 | 3.460874 | 2.988553 | 3.490671 | 4.216373 | 3.379886 | 3.463291 | 3.739586 |
| 3.142574 | 2.720044 | 3.67111 | 1.733075 | 2.04238 | 2.460396 | 3.27564 | 2.754309 | 2.281875 | 2.259846 |
| 2.014385 | 2.086951 | 1.166642 | 2.626304 | 1.569675 | 2.01683 | 2.066841 | 1.706975 | 2.716296 | 2.878751 |
| 1.51386 | 1.854313 | 1.804883 | 0.8599483 | 1.273463 | 0.6254871 | 1.444154 | 1.065096 | 0.8217195 | 2.590835 |
| 1.227762 | 1.515287 | 1.674812 | 0.8293704 | 0.7658936 | 1.47209 | 1.683081 | 1.783667 | 1.49975 | 1.216565 |
| 1.135807 | 1.401695 | 1.190076 | 0.8675064 | 0.9049118 | 0.8341491 | 1.008371 | 0.6006545 | 1.141123 | 0.2576165 |
| 0.9689382 | 0.9218824 | 0.9020656 | 0.7902049 | 0.8442089 | 0.7181688 | 0.8856366 | 0.6236158 | 1.094664 | 0.7212779 |
| 0.798745 | 0.8775647 | 0.9895598 | 0.8348727 | 0.6673348 | 0.4942513 | 0.9691612 | 0.5405215 | 0.7463209 | 1.027303 |
| 0.4830383 | 0.6939388 | 0.8564812 | 0.4329683 | 0.7199171 | 0.5557203 | 0.9174718 | 0.5480421 | 0.6396522 | 0.9719392 |
| 0.4636488 | 0.719988 | 0.8117428 | 0.6373911 | 0.6535155 | 0.5549338 | 0.7661236 | 0.4293767 | 0.6954247 | 0.6685155 |
| 0.6167037 | 0.650049 | 0.9597621 | 0.6540148 | 0.6595691 | 0.4253251 | 0.856373 | 0.6182644 | 0.4354768 | 0.479597 |
| 0.4319737 | 0.4137692 | 0.8114519 | 0.4525734 | 0.7079667 | 0.6350312 | 0.745761 | 0.5519755 | 0.5861388 | 0.8885071 |
| -0.1468943 | -0.2294916 | -0.3822119 | -0.2485941 | -0.2347955 | -0.2579478 | -0.226027 | -7.28E-02 | -0.248096 | -0.5970548 |

Hasil analisis Fourier quadran b' (Gambar 4.6.) kiri untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 58.84965 | 72.08362 | 60.55023 | 65.17757 | 59.47082 | 63.3402 | 59.33043 | 61.81411 | 63.61325 | 58.74504 |
| 16.98408 | 10.55803 | 17.0506 | 15.41222 | 16.03973 | 17.81775 | 16.76896 | 16.24046 | 15.43062 | 16.24683 |
| 7.280131 | 4.846152 | 6.246106 | 6.520953 | 6.858326 | 7.104464 | 7.962971 | 6.468109 | 6.675861 | 6.790902 |
| 4.6637 | 3.335654 | 4.087844 | 3.872414 | 4.077603 | 3.585835 | 4.78209 | 4.048975 | 3.814815 | 5.173726 |
| 3.355957 | 2.308719 | 2.551834 | 2.504091 | 3.141133 | 2.208459 | 3.545135 | 2.859357 | 2.428499 | 2.590415 |
| 1.215405 | 1.215452 | 2.064287 | 0.9912519 | 1.593636 | 0.6733408 | 1.898626 | 2.17686 | 1.986377 | 2.465252 |
| 1.196601 | 1.74806 | 1.16216 | 1.169741 | 1.943718 | 2.042802 | 1.919898 | 1.011388 | 0.9426584 | 2.055747 |
| 1.178165 | 0.2228419 | 1.407676 | 1.084308 | 1.327931 | 1.370041 | 1.889495 | 1.261998 | 1.372811 | 1.108339 |
| 1.143191 | 0.9761161 | 1.064804 | 0.690709 | 1.39242 | 0.7834089 | 0.9836196 | 0.8750034 | 1.057734 | 1.352628 |
| 1.226557 | 0.5724443 | 0.7154523 | 0.8308788 | 1.089844 | 0.5466207 | 0.7239752 | 0.6456476 | 0.9904229 | 0.824864 |
| 0.8340724 | 0.5261977 | 0.8708874 | 0.4370516 | 0.9584841 | 0.5227257 | 0.5817278 | 0.7167081 | 0.7897437 | 0.8314391 |
| 0.6579955 | 0.5004817 | 0.8232494 | 0.4888713 | 0.8288806 | 0.4786195 | 0.6340483 | 0.7210005 | 0.5771894 | 0.8962863 |
| 0.6209613 | 0.4527826 | 0.5873678 | 0.3826613 | 0.5537403 | 0.7789817 | 0.6114803 | 0.6908948 | 0.5821916 | 0.8765631 |
| 0.5598456 | 0.3021475 | 0.5158951 | 0.498848 | 0.8159252 | 0.6008465 | 0.7742645 | 0.5840456 | 0.5562254 | 0.7876928 |
| 0.5875625 | 0.5980968 | 0.6173282 | 0.2869324 | 0.7425063 | 0.4644811 | 0.6631113 | 0.4841811 | 0.6856533 | 0.7202149 |
| -0.4594152 | -0.1236828 | -0.286244 | -0.2971629 | -0.228097 | -0.203403 | -0.2795658 | -0.332272 | -0.2893394 | -0.3157847 |

Hasil analisis Fourier quadran c' (Gambar 4.6.) kiri untuk tengkorak 1 - 10

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 59.79127 | 63.13541 | 76.42333 | 55.87855 | 59.58265 | 57.68226 | 79.23691 | 59.32765 | 56.26129 | 59.69682 |
| 17.33294 | 18.11657 | 13.67246 | 14.56628 | 15.38035 | 14.25032 | 9.669919 | 17.34576 | 15.25099 | 18.73629 |
| 7.145331 | 6.683913 | 5.527498 | 8.769041 | 8.20756 | 5.763111 | 3.596486 | 7.446882 | 9.020561 | 8.161081 |
| 3.552376 | 4.743947 | 4.621363 | 5.606874 | 4.781461 | 4.732111 | 4.815315 | 3.555846 | 3.366471 | 4.258182 |
| 3.001283 | 2.835301 | 2.078349 | 3.630958 | 2.955953 | 3.058445 | 3.578519 | 2.953806 | 3.409254 | 1.974883 |
| 1.795825 | 2.408753 | 2.395651 | 2.203287 | 2.089454 | 2.165963 | 0.8365483 | 2.75801 | 2.535242 | 1.555435 |
| 2.14495 | 2.296272 | 1.595404 | 2.479879 | 1.85452 | 2.208474 | 2.264144 | 1.307487 | 1.868426 | 1.673011 |
| 1.340298 | 1.009381 | 0.6476245 | 1.377801 | 2.031738 | 1.244524 | 1.302403 | 1.556671 | 1.522993 | 0.9833982 |
| 1.197 | 0.8596359 | 1.522872 | 1.257168 | 1.227599 | 1.407223 | 1.237365 | 0.7841056 | 1.227882 | 1.288811 |
| 1.298778 | 0.8659056 | 0.9805383 | 1.092303 | 0.7329788 | 1.546143 | 1.025258 | 0.7013236 | 1.494469 | 1.237931 |
| 1.283737 | 1.092824 | 0.747773 | 0.9603841 | 0.8737506 | 1.155343 | 1.099165 | 0.5837071 | 1.002003 | 0.5992862 |
| 0.8370411 | 1.090283 | 0.6537628 | 1.009245 | 0.861968 | 1.244523 | 0.8936768 | 0.7648985 | 0.9325814 | 1.134429 |
| 0.7592323 | 0.8364571 | 0.5005799 | 1.110441 | 0.8847996 | 1.107726 | 0.4888833 | 0.6822447 | 0.8608242 | 0.7000908 |
| 0.8947629 | 0.9477249 | 0.6894593 | 0.8885861 | 1.007651 | 1.102814 | 0.7604675 | 0.4821275 | 0.955083 | 0.7238864 |
| 0.8991511 | 0.8697988 | 0.5618128 | 0.7859051 | 0.6490979 | 1.036269 | 0.6160385 | 0.7802436 | 0.574176 | 0.4801629 |
| -0.3297358 | -0.5196315 | -0.1658423 | -0.3702656 | -0.2743699 | -0.5426908 | -0.2150577 | -0.384384 | -0.3291755 | -0.153875 |

Hasil analisis Fourier quadran d' (Gambar 4.6.) kiri untuk tengkorak 1 - 10

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 56.46166 | 71.51825 | 67.45354 | 61.70043 | 64.95556 | 62.28345 | 61.40222 | 67.33761 | 52.97446 | 53.99224 |
| 16.72144 | 14.76744 | 15.14558 | 12.59216 | 13.67601 | 12.93805 | 13.52816 | 12.10905 | 18.23243 | 19.99275 |
| 8.328498 | 7.042185 | 7.26822 | 6.527991 | 6.32815 | 8.09476 | 6.527519 | 6.285209 | 8.376163 | 7.943324 |
| 4.760447 | 5.091066 | 3.739535 | 4.655337 | 3.538007 | 5.440295 | 4.337997 | 4.275557 | 5.158501 | 5.470612 |
| 3.482706 | 3.577531 | 2.204497 | 2.960944 | 2.681681 | 3.196057 | 2.564485 | 3.313185 | 3.697684 | 2.87313 |
| 2.546606 | 2.473392 | 2.308772 | 2.292843 | 1.439845 | 1.756931 | 1.934163 | 2.301546 | 2.093731 | 2.371783 |
| 2.648438 | 1.794383 | 0.7601038 | 1.760195 | 1.737309 | 2.328357 | 1.862969 | 1.150728 | 1.901992 | 1.732422 |
| 2.244337 | 1.815488 | 1.209594 | 1.867191 | 0.6035265 | 1.476272 | 1.819537 | 1.458351 | 1.855388 | 0.555637 |
| 1.887157 | 1.061315 | 0.9523746 | 1.531159 | 1.303976 | 0.8543149 | 1.409574 | 1.142128 | 1.756575 | 1.131226 |
| 1.213887 | 0.6295645 | 0.7967046 | 1.28823 | 0.9917619 | 0.885474 | 1.068325 | 0.9127806 | 1.07469 | 1.398426 |
| 0.8281639 | 0.6748718 | 0.8492408 | 1.296799 | 0.8487928 | 0.6221771 | 0.8833956 | 0.8257706 | 0.8690679 | 1.084714 |
| 1.157337 | 0.5747079 | 0.6825075 | 0.9870138 | 0.6128313 | 0.719193 | 0.8151435 | 0.6487803 | 0.821373 | 1.018729 |
| 0.9529005 | 0.4607292 | 0.711104 | 0.821442 | 0.729375 | 0.8561296 | 0.8684121 | 0.5386295 | 0.5297757 | 0.7817276 |
| 1.100027 | 0.7171048 | 0.562278 | 0.9998085 | 0.5639132 | 0.8400008 | 0.7885968 | 0.5586391 | 0.5883498 | 0.8114098 |
| 0.81096 | 0.7089727 | 0.4722647 | 0.9380985 | 0.7560914 | 0.5329909 | 0.54523 | 0.6410451 | 0.6251272 | 0.7072138 |
| -0.355389 | -0.2388376 | -0.3407972 | -0.4553182 | -0.2269727 | -0.4241587 | -0.3712232 | -0.4027613 | -0.3049518 | -0.2045672 |

Hasil analisis Fourier quadran c' (Gambar 4.6.) kiri untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 66.87893 | 61.00959 | 59.07209 | 63.07752 | 62.83171 | 62.31594 | 65.82645 | 57.82809 | 63.61325 | 58.34812 |
| 14.59809 | 16.67819 | 17.23422 | 20.61235 | 15.47716 | 17.67325 | 11.66673 | 17.18534 | 15.43062 | 16.77105 |
| 5.521094 | 6.488061 | 6.357706 | 8.394534 | 8.561232 | 8.166884 | 5.005417 | 7.727982 | 6.675861 | 8.098338 |
| 3.863876 | 4.311086 | 5.096428 | 3.965565 | 3.883292 | 4.62527 | 4.252975 | 4.088455 | 3.814815 | 5.193681 |
| 2.267706 | 2.705483 | 2.492915 | 1.394305 | 2.678501 | 2.317258 | 2.319881 | 2.727831 | 2.428499 | 2.571662 |
| 1.803818 | 1.61439 | 2.690707 | 0.8790421 | 1.648518 | 1.465134 | 2.260521 | 2.421928 | 1.986377 | 2.762226 |
| 1.242553 | 1.914892 | 1.788745 | 1.104448 | 1.446333 | 1.39275 | 2.052852 | 1.556865 | 0.9426584 | 0.9385758 |
| 0.8049366 | 0.7653296 | 1.000115 | 0.5052987 | 1.229267 | 1.127791 | 0.9259277 | 1.244111 | 1.372811 | 0.8593169 |
| 0.5722035 | 0.8617394 | 1.314097 | 0.6687056 | 0.7245723 | 0.8453404 | 1.267383 | 1.283626 | 1.057734 | 1.12658 |
| 0.8160436 | 0.7634639 | 1.284739 | 0.7712124 | 0.6478927 | 0.9306375 | 0.9772261 | 1.189559 | 0.9904229 | 0.8273971 |
| 0.6965132 | 0.5929725 | 1.026109 | 0.4914266 | 0.5186048 | 0.7427083 | 0.783321 | 0.9739128 | 0.7897437 | 0.8725829 |
| 0.4465123 | 0.6091358 | 0.7841725 | 0.2458373 | 0.6127397 | 0.3551946 | 0.8936528 | 0.507675 | 0.5771894 | 0.3961713 |
| 0.5447235 | 0.724466 | 0.7194692 | 0.3260811 | 0.5158973 | 0.3006884 | 0.5249068 | 0.5316499 | 0.5821916 | 0.5950116 |
| 0.5738411 | 0.5763723 | 0.771581 | 0.3265447 | 0.4651115 | 0.4270177 | 0.6335556 | 0.7518385 | 0.5562254 | 0.646422 |
| 0.2371787 | 0.6050596 | 0.5498771 | 0.4279421 | 0.4326872 | 0.5039929 | 0.6052453 | 0.5424168 | 0.6856533 | 0.4682026 |
| -0.1951638 | -0.2359679 | -0.1970963 | -0.2478184 | -0.2473864 | -0.325465 | -0.2521839 | -0.2357197 | -0.2893394 | -0.3230043 |

Hasil analisis Fourier quadran d' (Gambar 4.6.) kiri untuk tengkorak 11 - 20

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 59.50052 | 56.29245 | 58.20825 | 66.30939 | 72.44918 | 74.00899 | 63.58394 | 61.71612 | 56.99975 | 66.76138 |
| 18.28775 | 15.72511 | 17.55932 | 12.78966 | 13.9525 | 20.22499 | 15.3389 | 13.29575 | 19.97435 | 12.48382 |
| 6.437569 | 7.15769 | 6.984001 | 7.761044 | 3.969097 | 10.99588 | 7.843488 | 8.532148 | 5.207613 | 6.485057 |
| 4.248006 | 4.549333 | 4.722615 | 3.695593 | 4.186734 | 3.952484 | 3.372765 | 4.989932 | 4.887342 | 3.901343 |
| 3.081162 | 3.02622 | 3.137621 | 1.810134 | 1.473072 | 2.911875 | 2.595297 | 3.376922 | 2.406958 | 2.891276 |
| 2.300797 | 2.213928 | 2.260637 | 1.58508 | 1.583637 | 2.356598 | 2.45576 | 2.446057 | 2.902825 | 1.642856 |
| 1.200336 | 2.544176 | 2.10675 | 1.895605 | 1.119751 | 2.337593 | 1.112988 | 1.764444 | 1.225012 | 1.751821 |
| 1.56453 | 1.356184 | 1.091935 | 0.8760755 | 1.49693 | 0.7693947 | 1.036121 | 1.474034 | 1.475339 | 1.75839 |
| 1.641961 | 1.443435 | 1.104172 | 0.9459873 | 0.6672102 | 0.8964597 | 0.9879541 | 0.8628552 | 1.573433 | 1.327352 |
| 1.1868 | 1.330513 | 1.110984 | 0.7160318 | 0.676881 | 1.347268 | 1.109728 | 0.6022368 | 0.9023889 | 1.12489 |
| 0.7661689 | 1.073591 | 1.041129 | 0.4143925 | 0.5033211 | 1.403211 | 0.9844938 | 0.5293723 | 0.8609838 | 1.056927 |
| 0.7696604 | 1.056341 | 1.047395 | 0.81889 | 0.4761404 | 0.932587 | 0.8133922 | 0.638755 | 0.8167875 | 0.820117 |
| 0.7118383 | 1.063258 | 0.8287849 | 0.4751644 | 0.4427537 | 0.8096081 | 0.829038 | 0.5849844 | 0.7819723 | 0.6717856 |
| 0.5466042 | 1.108138 | 0.8385011 | 0.8142573 | 0.3344178 | 0.633914 | 0.784774 | 0.6948079 | 0.6577813 | 0.8675478 |
| 0.7440763 | 0.9055287 | 0.9464204 | 0.4005347 | 0.4773872 | 0.6903681 | 0.6090611 | 0.5188614 | 0.4484328 | 0.6884361 |
| -0.4686296 | -0.3665166 | -0.4330994 | -0.2423879 | -5.93E-02 | -0.3088718 | -0.3095815 | -0.3622384 | -0.4111814 | -0.3981097 |

# Lampiran IV

## Analisis statistik untuk quadran *a* (Gambar 4.6.) kanan dibandingkan dengan yang kiri

## Discriminant

**Warnings**

| |
|---|
| All-Groups Stacked Histogram is no longer displayed. |

**Analysis Case Processing Summary**

| Unweighted Cases | | N | Percent |
|---|---|---|---|
| Valid | | 40 | 100,0 |
| Excluded | Missing or out-of-range group codes | 0 | ,0 |
| | At least one missing discriminating variable | 0 | ,0 |
| | Both missing or out-of-range group codes and at least one missing discriminating variable | 0 | ,0 |
| | Total | 0 | ,0 |
| Total | | 40 | 100,0 |

**Tests of Equality of Group Means**

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| VAR001 | ,954 | 1,839 | 1 | 38 | ,183 |
| VAR002 | ,995 | ,176 | 1 | 38 | ,677 |
| VAR003 | ,964 | 1,419 | 1 | 38 | .241 |
| VAR004 | ,954 | 1,821 | 1 | 38 | .185 |
| VAR005 | ,982 | ,701 | 1 | 38 | .408 |
| VAR006 | ,873 | 5,541 | 1 | 38 | .024 |
| VAR007 | ,972 | 1,092 | 1 | 38 | ,303 |
| VAR008 | ,998 | ,060 | 1 | 38 | ,808 |
| VAR009 | ,961 | 1,547 | 1 | 38 | ,221 |
| VAR010 | ,890 | 4,680 | 1 | 38 | ,037 |
| VAR011 | ,907 | 3,894 | 1 | 38 | ,056 |
| VAR012 | ,907 | 3,917 | 1 | 38 | ,055 |
| VAR013 | ,894 | 4,523 | 1 | 38 | ,040 |
| VAR014 | ,898 | 4,307 | 1 | 38 | ,045 |
| VAR015 | ,935 | 2,637 | 1 | 38 | .113 |
| VAR016 | ,907 | 3,900 | 1 | 38 | ,056 |

# Analysis 1
# Stepwise Statistics

**Variables Entered/Removed[a,b,c,d]**

| | | Min. D Squared | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Exact F | | | |
| Step | Entered | Statistic | Between Groups | Statistic | df1 | df2 | Sig. |
| 1 | VAR006 | ,554 | kanan and kiri | 5,541 | 1 | 38,000 | 2,385E-02 |

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 32.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

**Variables in the Analysis**

| Step | | Tolerance | F to Remove |
|---|---|---|---|
| 1 | VAR006 | 1,000 | 5,541 |

**Variables Not in the Analysis**

| Step | | Tolerance | Min. Tolerance | F to Enter | Min. D Squared | Between Groups |
|---|---|---|---|---|---|---|
| 0 | VAR001 | 1,000 | 1,000 | 1,839 | ,184 | kanan and kiri |
| | VAR002 | 1,000 | 1,000 | ,176 | ,018 | kanan and kiri |
| | VAR003 | 1,000 | 1,000 | 1,419 | ,142 | kanan and kiri |
| | VAR004 | 1,000 | 1,000 | 1,821 | ,182 | kanan and kiri |
| | VAR005 | 1,000 | 1,000 | ,701 | ,070 | kanan and kiri |
| | VAR006 | 1,000 | 1,000 | 5,541 | ,554 | kanan and kiri |
| | VAR007 | 1,000 | 1,000 | 1,092 | ,109 | kanan and kiri |
| | VAR008 | 1,000 | 1,000 | ,060 | ,006 | kanan and kiri |
| | VAR009 | 1,000 | 1,000 | 1,547 | ,155 | kanan and kiri |
| | VAR010 | 1,000 | 1,000 | 4,680 | ,468 | kanan and kiri |
| | VAR011 | 1,000 | 1,000 | 3,894 | ,389 | kanan and kiri |
| | VAR012 | 1,000 | 1,000 | 3,917 | ,392 | kanan and kiri |
| | VAR013 | 1,000 | 1,000 | 4,523 | ,452 | kanan and kiri |
| | VAR014 | 1,000 | 1,000 | 4,307 | ,431 | kanan and kiri |
| | VAR015 | 1,000 | 1,000 | 2,637 | ,264 | kanan and kiri |
| | VAR016 | 1,000 | 1,000 | 3,900 | ,390 | kanan and kiri |
| 1 | VAR001 | ,719 | ,719 | ,014 | ,556 | kanan and kiri |
| | VAR002 | ,811 | ,811 | ,382 | ,599 | kanan and kiri |
| | VAR003 | ,918 | ,918 | ,246 | ,583 | kanan and kiri |
| | VAR004 | ,827 | ,827 | ,140 | ,571 | kanan and kiri |
| | VAR005 | ,988 | ,988 | ,294 | ,589 | kanan and kiri |
| | VAR007 | ,943 | ,943 | ,210 | ,579 | kanan and kiri |
| | VAR008 | ,996 | ,996 | ,007 | ,555 | kanan and kiri |
| | VAR009 | ,933 | ,933 | ,367 | ,597 | kanan and kiri |
| | VAR010 | ,908 | ,908 | 1,964 | ,785 | kanan and kiri |
| | VAR011 | ,983 | ,983 | 2,404 | ,837 | kanan and kiri |
| | VAR012 | ,968 | ,968 | 2,134 | ,805 | kanan and kiri |

**Group Statistics**

| lokasi | | Mean | Std. Deviation | Valid N (listwise) Unweighted | Valid N (listwise) Weighted |
|---|---|---|---|---|---|
| kanan | VAR001 | 60,06332 | 9,3030166 | 20 | 20,000 |
| | VAR002 | 15,89531 | 3,3223948 | 20 | 20,000 |
| | VAR003 | 7,3460615 | 2,0761431 | 20 | 20,000 |
| | VAR004 | 4,4682993 | 1,5742243 | 20 | 20,000 |
| | VAR005 | 3,0872204 | ,9109817 | 20 | 20,000 |
| | VAR006 | 2,5436638 | ,7431152 | 20 | 20,000 |
| | VAR007 | 1,7942883 | ,6621686 | 20 | 20,000 |
| | VAR008 | 1,2947045 | ,5553513 | 20 | 20,000 |
| | VAR009 | 1,2271593 | ,4409041 | 20 | 20,000 |
| | VAR010 | 1,1366611 | ,3849640 | 20 | 20,000 |
| | VAR011 | ,9995436 | ,4447061 | 20 | 20,000 |
| | VAR012 | ,9333266 | ,4766064 | 20 | 20,000 |
| | VAR013 | ,8337194 | ,3790517 | 20 | 20,000 |
| | VAR014 | ,8386278 | ,3003764 | 20 | 20,000 |
| | VAR015 | ,7597708 | ,3204507 | 20 | 20,000 |
| | VAR016 | -,3723110 | ,1800712 | 20 | 20,000 |
| kiri | VAR001 | 63,43971 | 6,1168335 | 20 | 20,000 |
| | VAR002 | 15,43498 | 3,6105922 | 20 | 20,000 |
| | VAR003 | 6,6478302 | 1,6002968 | 20 | 20,000 |
| | VAR004 | 3,8818076 | 1,1401971 | 20 | 20,000 |
| | VAR005 | 2,8692361 | ,7246796 | 20 | 20,000 |
| | VAR006 | 2,0608657 | ,5377498 | 20 | 20,000 |
| | VAR007 | 1,5968539 | ,5248178 | 20 | 20,000 |
| | VAR008 | 1,2597121 | ,3179082 | 20 | 20,000 |
| | VAR009 | 1,0650326 | ,3812660 | 20 | 20,000 |
| | VAR010 | ,9255983 | ,2053635 | 20 | 20,000 |
| | VAR011 | ,7666744 | ,2841920 | 20 | 20,000 |
| | VAR012 | ,7061409 | ,1907498 | 20 | 20,000 |
| | VAR013 | ,6393546 | ,1528794 | 20 | 20,000 |
| | VAR014 | ,6770297 | ,1761747 | 20 | 20,000 |
| | VAR015 | ,6303714 | ,1559803 | 20 | 20,000 |
| | VAR016 | -,2786650 | ,1120173 | 20 | 20,000 |

**Wilks' Lambda**

| Step | Number of Variables | Lambda | df1 | df2 | df3 | Exact F | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Statistic | df1 | df2 | Sig. |
| 1 | 1 | ,873 | 1 | 1 | 38 | 5,541 | 1 | 38,000 | 2,385E-02 |

# Summary of Canonical Discriminant Functions

**Eigenvalues**

| Function | Eigenvalue | % of Variance | Cumulative % | Canonical Correlation |
|---|---|---|---|---|
| 1 | ,146[a] | 100,0 | 100,0 | ,357 |

a. First 1 canonical discriminant functions were used in the analysis.

**Wilks' Lambda**

| Test of Function(s) | Wilks' Lambda | Chi-square | df | Sig. |
|---|---|---|---|---|
| 1 | ,873 | 5,104 | 1 | ,024 |

**Standardized Canonical Discriminant Function Coefficients**

| | Function |
|---|---|
| | 1 |
| VAR006 | 1,000 |

**Structure Matrix**

| | Function |
|---|---|
| | 1 |
| VAR006 | 1,000 |
| VAR001[a] | -,531 |
| VAR002[a] | ,435 |
| VAR004[a] | ,416 |
| VAR013[a] | ,358 |
| VAR010[a] | ,304 |
| VAR003[a] | ,287 |
| VAR015[a] | ,265 |
| VAR009[a] | ,259 |
| VAR007[a] | ,239 |
| VAR012[a] | ,178 |
| VAR011[a] | ,130 |
| VAR005[a] | ,107 |
| VAR016[a] | -,086 |
| VAR008[a] | ,066 |
| VAR014[a] | ,024 |

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

**Canonical Discriminant Function Coefficients**

| | Function |
|---|---|
| | 1 |
| VAR006 | 1,542 |
| (Constant) | -3,550 |

Unstandardized coefficients

**Functions at Group Centroids**

| | Function |
|---|---|
| lokasi | 1 |
| kanan | ,372 |
| kiri | -,372 |

Unstandardized canonical discriminant functions evaluated at group means

# Classification Statistics

**Classification Processing Summary**

| | | |
|---|---|---|
| Processed | | 40 |
| Excluded | Missing or out-of-range group codes | 0 |
| | At least one missing discriminating variable | 0 |
| Used in Output | | 40 |

**Prior Probabilities for Groups**

| lokasi | Prior | Cases Used in Analysis | |
|---|---|---|---|
| | | Unweighted | Weighted |
| kanan | ,500 | 20 | 20,000 |
| kiri | ,500 | 20 | 20,000 |
| Total | 1,000 | 40 | 40,000 |

**Classification Function Coefficients**

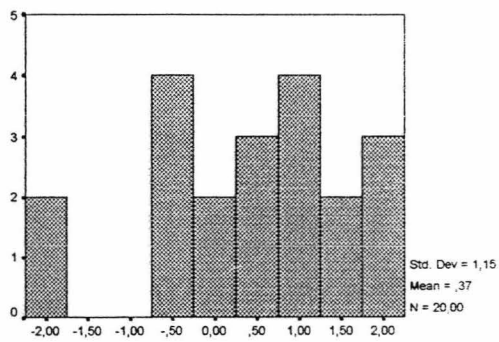
| | lokasi | |
|---|---|---|
| | kanan | kiri |
| VAR006 | 6,046 | 4,899 |
| (Constant) | -8,383 | -5,741 |

Fisher's linear discriminant functions

# Separate-Groups Graphs

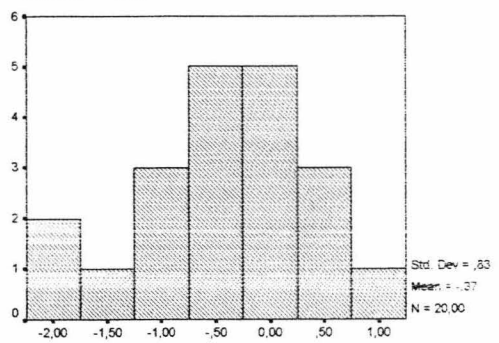
Canonical Discriminant Function 1

lokasi = kanan




Canonical Discriminant Function 1

lokasi = kiri



**Classification Results[a]**

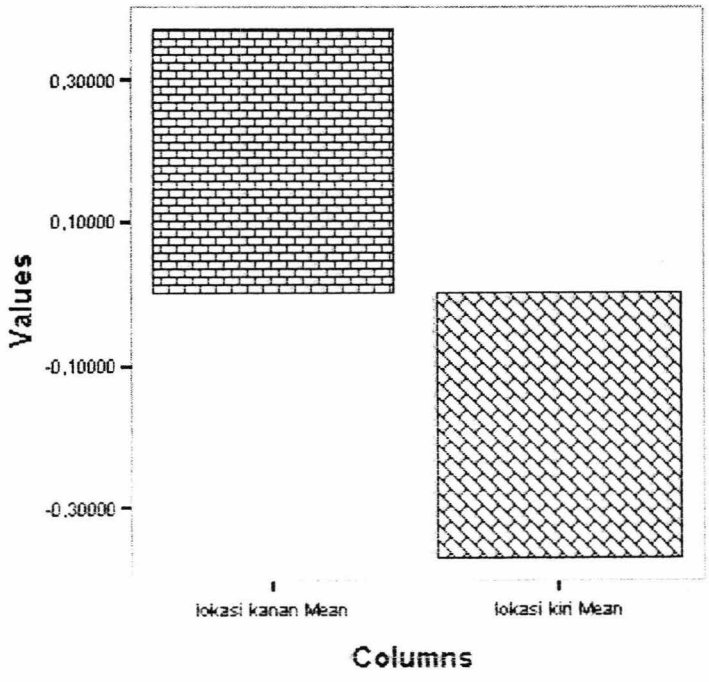
| | | | Predicted Group Membership | | |
|---|---|---|---|---|---|
| | | lokasi | kanan | kiri | Total |
| Original | Count | kanan | 13 | 7 | 20 |
| | | kiri | 8 | 12 | 20 |
| | % | kanan | 65,0 | 35,0 | 100,0 |
| | | kiri | 40,0 | 60,0 | 100,0 |

a. 62,5% of original grouped cases correctly classified.

## Tables

| | lokasi | |
|---|---|---|
| | kanan | kiri |
| | Mean | Mean |
| Discriminant Scores from Function 1 for Analysis 1 | ,37218 | -,37218 |

**Rows : Discriminant Scores from Function 1 for Analysis 1**




## T-Test

**Group Statistics**

| | lokasi | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR001 | kanan | 20 | 60,06332 | 9,3030166 | 2,0802178 |
| | kiri | 20 | 63,43971 | 6,1168335 | 1,3677655 |
| VAR002 | kanan | 20 | 15,89531 | 3,3223948 | ,7429101 |
| | kiri | 20 | 15,43498 | 3,6105922 | ,8073530 |
| VAR003 | kanan | 20 | 7,3460615 | 2,0761431 | ,4642397 |
| | kiri | 20 | 6,6478302 | 1,6002968 | ,3578372 |
| VAR004 | kanan | 20 | 4,4682993 | 1,5742243 | ,3520073 |
| | kiri | 20 | 3,8818076 | 1,1401971 | ,2549558 |
| VAR005 | kanan | 20 | 3,0872204 | ,9109817 | ,2037017 |
| | kiri | 20 | 2,8692361 | ,7246796 | ,1620433 |
| VAR006 | kanan | 20 | 2,5436638 | ,7431152 | ,1661656 |
| | kiri | 20 | 2,0608657 | ,5377498 | ,1202445 |
| VAR007 | kanan | 20 | 1,7942883 | ,6621686 | ,1480654 |
| | kiri | 20 | 1,5968539 | ,5248178 | ,1173528 |
| VAR008 | kanan | 20 | 1,2947045 | ,5553513 | ,1241803 |
| | kiri | 20 | 1,2597121 | ,3179082 | 7,11E-02 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR001 | Equal variances assumed | 2,973 | ,093 | -1,356 | 38 | ,183 | -3,3764 | 2,48960 |
| | Equal variances not assumed | | | -1,356 | 32,841 | ,184 | -3,3764 | 2,48960 |
| VAR002 | Equal variances assumed | ,061 | ,807 | ,420 | 38 | ,677 | ,460330 | 1,09715 |
| | Equal variances not assumed | | | ,420 | 37,740 | ,677 | ,460330 | 1,09715 |
| VAR003 | Equal variances assumed | 1,314 | ,259 | 1,191 | 38 | ,241 | ,698231 | ,5861450 |
| | Equal variances not assumed | | | 1,191 | 35,687 | ,241 | ,698231 | ,5861450 |
| VAR004 | Equal variances assumed | 2,668 | ,111 | 1,349 | 38 | ,185 | ,586492 | ,4346396 |
| | Equal variances not assumed | | | 1,349 | 34,633 | ,186 | ,586492 | ,4346396 |
| VAR005 | Equal variances assumed | 1,332 | ,256 | ,837 | 38 | ,408 | ,217984 | ,2602929 |
| | Equal variances not assumed | | | ,837 | 36,171 | ,408 | ,217984 | ,2602929 |
| VAR006 | Equal variances assumed | 2,037 | ,162 | 2,354 | 38 | ,024 | ,482798 | ,2051091 |
| | Equal variances not assumed | | | 2,354 | 34,617 | ,024 | ,482798 | ,2051091 |
| VAR007 | Equal variances assumed | 1,217 | ,277 | 1,045 | 38 | ,303 | ,197434 | ,1889313 |
| | Equal variances not assumed | | | 1,045 | 36,116 | ,303 | ,197434 | ,1889313 |
| VAR008 | Equal variances assumed | 6,748 | ,013 | ,245 | 38 | ,808 | 3,5E-02 | ,1430875 |
| | Equal variances not assumed | | | ,245 | 30,245 | ,808 | 3,5E-02 | ,1430875 |

## T-Test

**Group Statistics**

| | lokasi | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR009 | kanan | 20 | 1,2271593 | ,4409041 | 9,86E-02 |
| | kiri | 20 | 1,0650326 | ,3812660 | 8,53E-02 |
| VAR010 | kanan | 20 | 1,1366611 | ,3849640 | 8,61E-02 |
| | kiri | 20 | ,9255983 | ,2053635 | 4,59E-02 |
| VAR011 | kanan | 20 | ,9995436 | ,4447061 | 9,94E-02 |
| | kiri | 20 | ,7666744 | ,2841920 | 6,35E-02 |
| VAR012 | kanan | 20 | ,9333266 | ,4766064 | ,1065724 |
| | kiri | 20 | ,7061409 | ,1907498 | 4,27E-02 |
| VAR013 | kanan | 20 | ,8337194 | ,3790517 | 8,48E-02 |
| | kiri | 20 | ,6393546 | ,1528794 | 3,42E-02 |
| VAR014 | kanan | 20 | ,8386278 | ,3003764 | 6,72E-02 |
| | kiri | 20 | ,6770297 | ,1761747 | 3,94E-02 |
| VAR015 | kanan | 20 | ,7597708 | ,3204507 | 7,17E-02 |
| | kiri | 20 | ,6303714 | ,1559803 | 3,49E-02 |
| VAR016 | kanan | 20 | -,3723110 | ,1800712 | 4,03E-02 |
| | kiri | 20 | -,2786650 | ,1120173 | 2,50E-02 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR009 | Equal variances assumed | 1,855 | ,181 | 1,244 | 38 | ,221 | ,162127 | ,130338 |
| | Equal variances not assumed | | | 1,244 | 37,225 | ,221 | ,162127 | ,130338 |
| VAR010 | Equal variances assumed | 6,551 | ,015 | 2,163 | 38 | ,037 | ,211063 | 9,8E-02 |
| | Equal variances not assumed | | | 2,163 | 29,004 | ,039 | ,211063 | 9,8E-02 |
| VAR011 | Equal variances assumed | 2,867 | ,099 | 1,973 | 38 | ,056 | ,232869 | ,118010 |
| | Equal variances not assumed | | | 1,973 | 32,301 | ,057 | ,232869 | ,118010 |
| VAR012 | Equal variances assumed | 9,179 | ,004 | 1,979 | 38 | ,055 | ,227186 | ,114791 |
| | Equal variances not assumed | | | 1,979 | 24,935 | ,059 | ,227186 | ,114791 |
| VAR013 | Equal variances assumed | 13,3 | ,001 | 2,127 | 38 | ,040 | ,194365 | 9,1E-02 |
| | Equal variances not assumed | | | 2,127 | 25,022 | ,043 | ,194365 | 9,1E-02 |
| VAR014 | Equal variances assumed | 8,385 | ,006 | 2,075 | 38 | ,045 | ,161598 | 7,8E-02 |
| | Equal variances not assumed | | | 2,075 | 30,689 | ,046 | ,161598 | 7,8E-02 |
| VAR015 | Equal variances assumed | 12,8 | ,001 | 1,624 | 38 | ,113 | ,129399 | 8,0E-02 |
| | Equal variances not assumed | | | 1,624 | 27,525 | ,116 | ,129399 | 8,0E-02 |
| VAR016 | Equal variances assumed | 8,413 | ,006 | -1,97 | 38 | ,056 | -9,E-02 | 4,7E-02 |
| | Equal variances not assumed | | | -1,97 | 31,790 | ,057 | -9,E-02 | 4,7E-02 |

## Oneway

**Descriptives**

Discriminant Scores from Function 1 for Analysis 1

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| kanan | 20 | ,3721779 | 1,1457007 | ,2561865 | -,1640265 | ,9083823 |
| kiri | 20 | -,3721779 | ,8290778 | ,1853874 | -,7601982 | 1,58E-02 |
| Total | 40 | 6,66E-17 | 1,0566111 | ,1670649 | -,3379206 | ,3379206 |

**Test of Homogeneity of Variances**

Discriminant Scores from Function 1 for Analysis 1

| Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|
| 2,037 | 1 | 38 | ,162 |

**ANOVA**

Discriminant Scores from Function 1 for Analysis 1

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 5,541 | 1 | 5,541 | 5,541 | ,024 |
| Within Groups | 38,000 | 38 | 1,000 | | |
| Total | 43,541 | 39 | | | |

# Analisis statistik untuk quadran b (Gambar 4.6.) kanan dibandingkan dengan yang kiri



## Discriminant

**Warnings**

| |
|---|
| All-Groups Stacked Histogram is no longer displayed. |

**Analysis Case Processing Summary**

| Unweighted Cases | | N | Percent |
|---|---|---|---|
| Valid | | 40 | 100,0 |
| Excluded | Missing or out-of-range group codes | 0 | ,0 |
| | At least one missing discriminating variable | 0 | ,0 |
| | Both missing or out-of-range group codes and at least one missing discriminating variable | 0 | ,0 |
| | Total | 0 | ,0 |
| Total | | 40 | 100,0 |

**Group Statistics**

| LOKASI | | Mean | Std. Deviation | Valid N (listwise) Unweighted | Valid N (listwise) Weighted |
|---|---|---|---|---|---|
| kanan | VAR001 | 66,2135 | 7,2396 | 20 | 20,000 |
| | VAR002 | 15,2388 | 3,7590 | 20 | 20,000 |
| | VAR003 | 6,2184 | 1,6483 | 20 | 20,000 |
| | VAR004 | 3,7719 | ,8566 | 20 | 20,000 |
| | VAR005 | 2,4982 | ,6628 | 20 | 20,000 |
| | VAR006 | 1,6000 | ,6007 | 20 | 20,000 |
| | VAR007 | 1,3511 | ,6074 | 20 | 20,000 |
| | VAR008 | 1,1790 | ,3970 | 20 | 20,000 |
| | VAR009 | ,8425 | ,3386 | 20 | 20,000 |
| | VAR010 | ,7768 | ,2947 | 20 | 20,000 |
| | VAR011 | ,7154 | ,2215 | 20 | 20,000 |
| | VAR012 | ,6933 | ,1827 | 20 | 20,000 |
| | VAR013 | ,5995 | ,2074 | 20 | 20,000 |
| | VAR014 | ,5255 | ,2400 | 20 | 20,000 |
| | VAR015 | ,4954 | ,2087 | 20 | 20,000 |
| | VAR016 | -,2916 | ,1088 | 20 | 20,000 |
| kiri | VAR001 | 62,3122 | 3,5168 | 20 | 20,000 |
| | VAR002 | 16,2048 | 2,3574 | 20 | 20,000 |
| | VAR003 | 6,8189 | ,9976 | 20 | 20,000 |
| | VAR004 | 4,0838 | ,5320 | 20 | 20,000 |
| | VAR005 | 2,5219 | ,5085 | 20 | 20,000 |
| | VAR006 | 1,8586 | ,6294 | 20 | 20,000 |
| | VAR007 | 1,5059 | ,5587 | 20 | 20,000 |
| | VAR008 | 1,1961 | ,3944 | 20 | 20,000 |
| | VAR009 | 1,0595 | ,2195 | 20 | 20,000 |
| | VAR010 | ,8682 | ,2219 | 20 | 20,000 |
| | VAR011 | ,7083 | ,1900 | 20 | 20,000 |
| | VAR012 | ,6563 | ,2005 | 20 | 20,000 |
| | VAR013 | ,5847 | ,1830 | 20 | 20,000 |
| | VAR014 | ,6297 | ,1649 | 20 | 20,000 |
| | VAR015 | ,6147 | ,1759 | 20 | 20,000 |
| | VAR016 | -,2950 | 9,935E-02 | 20 | 20,000 |
| Total | VAR001 | 64,2629 | 5,9550 | 40 | 40,000 |
| | VAR002 | 15,7218 | 3,1353 | 40 | 40,000 |
| | VAR003 | 6,5187 | 1,3788 | 40 | 40,000 |
| | VAR004 | 3,9278 | ,7214 | 40 | 40,000 |
| | VAR005 | 2,5101 | ,5832 | 40 | 40,000 |
| | VAR006 | 1,7293 | ,6213 | 40 | 40,000 |
| | VAR007 | 1,4285 | ,5813 | 40 | 40,000 |
| | VAR008 | 1,1876 | ,3907 | 40 | 40,000 |
| | VAR009 | ,9510 | ,3023 | 40 | 40,000 |
| | VAR010 | ,8225 | ,2616 | 40 | 40,000 |
| | VAR011 | ,7119 | ,2037 | 40 | 40,000 |
| | VAR012 | ,6748 | ,1903 | 40 | 40,000 |
| | VAR013 | ,5921 | ,1932 | 40 | 40,000 |
| | VAR014 | ,5776 | ,2100 | 40 | 40,000 |
| | VAR015 | ,5550 | ,1999 | 40 | 40,000 |
| | VAR016 | -,2933 | ,1029 | 40 | 40,000 |

**Tests of Equality of Group Means**

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| VAR001 | ,890 | 4,699 | 1 | 38 | ,037 |
| VAR002 | ,976 | ,948 | 1 | 38 | ,336 |
| VAR003 | ,951 | 1,943 | 1 | 38 | ,171 |
| VAR004 | ,952 | 1,914 | 1 | 38 | ,175 |
| VAR005 | 1,000 | ,016 | 1 | 38 | ,900 |
| VAR006 | ,956 | 1,767 | 1 | 38 | ,192 |
| VAR007 | ,982 | ,704 | 1 | 38 | ,407 |
| VAR008 | 1,000 | ,019 | 1 | 38 | ,892 |
| VAR009 | ,868 | 5,786 | 1 | 38 | ,021 |
| VAR010 | ,969 | 1,227 | 1 | 38 | ,275 |
| VAR011 | 1,000 | ,012 | 1 | 38 | ,913 |
| VAR012 | ,990 | ,371 | 1 | 38 | ,546 |
| VAR013 | ,998 | ,057 | 1 | 38 | ,812 |
| VAR014 | ,937 | 2,560 | 1 | 38 | ,118 |
| VAR015 | ,909 | 3,818 | 1 | 38 | ,058 |
| VAR016 | 1,000 | ,010 | 1 | 38 | ,919 |

# Analysis 1
# Stepwise Statistics

**Variables Entered/Removed[a,b,c,d]**

| Step | Entered | Min. D Squared | | | | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | Between Groups | Exact F | | | |
| | | | | Statistic | df1 | df2 | Sig. |
| 1 | VAR009 | ,579 | kanan and kiri | 5,786 | 1 | 38,000 | 2,113E-02 |

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 32.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

**Variables in the Analysis**

| Step | | Tolerance | F to Remove |
|---|---|---|---|
| 1 | VAR009 | 1,000 | 5,786 |

**Variables Not in the Analysis**

| Step | | Tolerance | Min. Tolerance | F to Enter | Min. D Squared | Between Groups |
|---|---|---|---|---|---|---|
| 0 | VAR001 | 1,000 | 1,000 | 4,699 | ,470 | kanan and kiri |
| | VAR002 | 1,000 | 1,000 | ,948 | ,095 | kanan and kiri |
| | VAR003 | 1,000 | 1,000 | 1,943 | ,194 | kanan and kiri |
| | VAR004 | 1,000 | 1,000 | 1,914 | ,191 | kanan and kiri |
| | VAR005 | 1,000 | 1,000 | ,016 | ,002 | kanan and kiri |
| | VAR006 | 1,000 | 1,000 | 1,767 | ,177 | kanan and kiri |
| | VAR007 | 1,000 | 1,000 | ,704 | ,070 | kanan and kiri |
| | VAR008 | 1,000 | 1,000 | ,019 | ,002 | kanan and kiri |
| | VAR009 | 1,000 | 1,000 | 5,786 | ,579 | kanan and kiri |
| | VAR010 | 1,000 | 1,000 | 1,227 | ,123 | kanan and kiri |
| | VAR011 | 1,000 | 1,000 | ,012 | ,001 | kanan and kiri |
| | VAR012 | 1,000 | 1,000 | ,371 | ,037 | kanan and kiri |
| | VAR013 | 1,000 | 1,000 | ,057 | ,006 | kanan and kiri |
| | VAR014 | 1,000 | 1,000 | 2,560 | ,256 | kanan and kiri |
| | VAR015 | 1,000 | 1,000 | 3,818 | ,382 | kanan and kiri |
| | VAR016 | 1,000 | 1,000 | ,010 | ,001 | kanan and kiri |
| 1 | VAR001 | ,929 | ,929 | 2,116 | ,829 | kanan and kiri |
| | VAR002 | ,964 | ,964 | 1,801 | ,792 | kanan and kiri |
| | VAR003 | ,912 | ,912 | ,429 | ,629 | kanan and kiri |
| | VAR004 | ,860 | ,860 | ,229 | ,606 | kanan and kiri |
| | VAR005 | ,821 | ,821 | ,820 | ,676 | kanan and kiri |
| | VAR006 | ,813 | ,813 | ,087 | ,589 | kanan and kiri |
| | VAR007 | ,997 | ,997 | ,782 | ,671 | kanan and kiri |
| | VAR008 | ,997 | ,997 | ,000 | ,579 | kanan and kiri |
| | VAR010 | ,789 | ,789 | ,000 | ,579 | kanan and kiri |
| | VAR011 | ,786 | ,786 | 1,604 | ,768 | kanan and kiri |
| | VAR012 | ,948 | ,948 | 1,190 | ,719 | kanan and kiri |

**Wilks' Lambda**

| Step | Number of Variables | Lambda | df1 | df2 | df3 | Exact F | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Statistic | df1 | df2 | Sig. |
| 1 | 1 | ,868 | 1 | 1 | 38 | 5,786 | 1 | 38,000 | 2,113E-02 |

# Summary of Canonical Discriminant Functions

**Eigenvalues**

| Function | Eigenvalue | % of Variance | Cumulative % | Canonical Correlation |
|---|---|---|---|---|
| 1 | ,152[a] | 100,0 | 100,0 | ,364 |

a. First 1 canonical discriminant functions were used in the analysis.

**Wilks' Lambda**

| Test of Function(s) | Wilks' Lambda | Chi-square | df | Sig. |
|---|---|---|---|---|
| 1 | ,868 | 5,315 | 1 | ,021 |

**Standardized Canonical Discriminant Function Coefficients**

| | Function |
|---|---|
| | 1 |
| VAR009 | 1,000 |

**Structure Matrix**

| | Function |
|---|---|
| | 1 |
| VAR009 | 1,000 |
| VAR014[a] | ,469 |
| VAR011[a] | ,462 |
| VAR010[a] | ,460 |
| VAR015[a] | ,457 |
| VAR006[a] | ,432 |
| VAR005[a] | ,424 |
| VAR013[a] | ,377 |
| VAR004[a] | ,374 |
| VAR016[a] | -,302 |
| VAR003[a] | ,297 |
| VAR001[a] | -,267 |
| VAR012[a] | ,227 |
| VAR002[a] | -,191 |
| VAR008[a] | ,053 |
| VAR007[a] | -,051 |

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

**Canonical Discriminant Function Coefficients**

| | Function |
|---|---|
| | 1 |
| VAR009 | 3,505 |
| (Constant) | -3,333 |

Unstandardized coefficients

**Functions at Group Centroids**

| | Function |
|---|---|
| LOKASI | 1 |
| kanan | -,380 |
| kiri | ,380 |

Unstandardized canonical discriminant functions evaluated at group means

## Classification Statistics

**Classification Processing Summary**

| | | |
|---|---|---|
| Processed | | 40 |
| Excluded | Missing or out-of-range group codes | 0 |
| | At least one missing discriminating variable | 0 |
| Used in Output | | 40 |

**Prior Probabilities for Groups**

| LOKASI | Prior | Cases Used in Analysis | |
|---|---|---|---|
| | | Unweighted | Weighted |
| kanan | ,500 | 20 | 20,000 |
| kiri | ,500 | 20 | 20,000 |
| Total | 1,000 | 40 | 40,000 |

**Classification Function Coefficients**

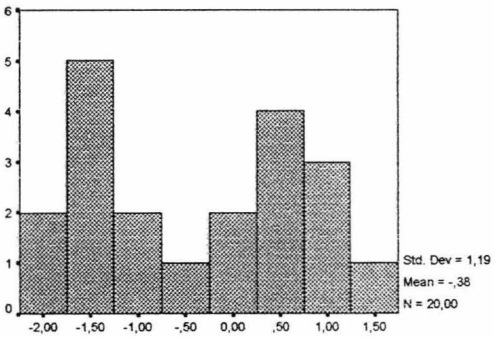
| | LOKASI | |
|---|---|---|
| | kanan | kiri |
| VAR009 | 10,348 | 13,014 |
| (Constant) | -5,052 | -7,587 |

Fisher's linear discriminant functions

## Separate-Groups Graphs

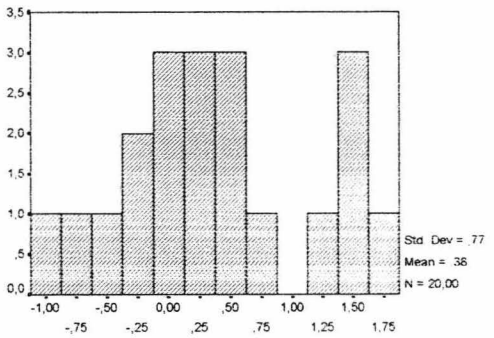
Canonical Discriminant Function 1

LOKASI = kanan




Canonical Discriminant Function 1

LOKASI = kiri



**Classification Results[a]**

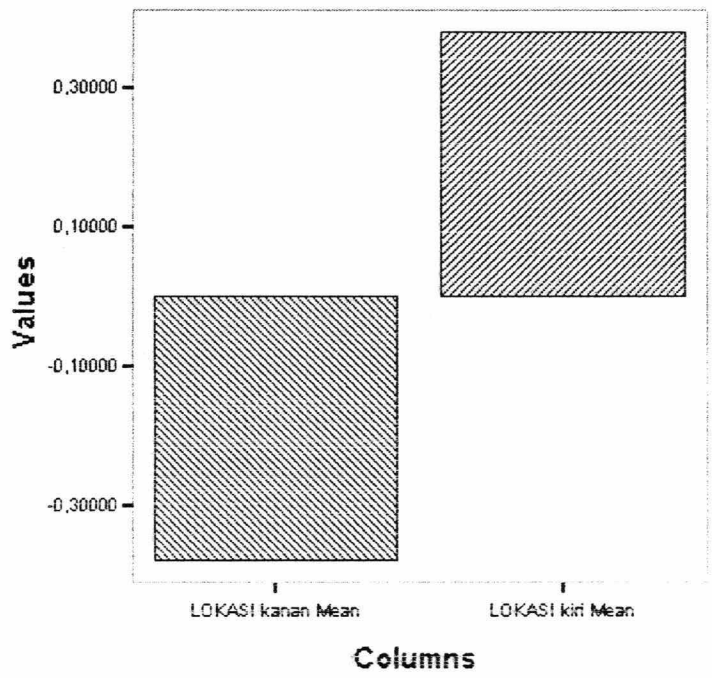
| | | | Predicted Group Membership | | |
|---|---|---|---|---|---|
| | | LOKASI | kanan | kiri | Total |
| Original | Count | kanan | 12 | 8 | 20 |
| | | kiri | 6 | 14 | 20 |
| | % | kanan | 60,0 | 40,0 | 100,0 |
| | | kiri | 30,0 | 70,0 | 100,0 |

a. 65,0% of original grouped cases correctly classified

## Tables

| | LOKASI | |
|---|---|---|
| | kanan | kiri |
| | Mean | Mean |
| Discriminant Scores from Function 1 for Analysis 1 | -,38033 | ,38033 |

**Rows : Discriminant Scores from Function 1 for Analysis 1**




## T-Test

**Group Statistics**

| | LOKASI | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR001 | kanan | 20 | 66,2135 | 7,2396 | 1,6188 |
| | kiri | 20 | 62,3122 | 3,5168 | ,7864 |
| VAR002 | kanan | 20 | 15,2388 | 3,7590 | ,8405 |
| | kiri | 20 | 16,2048 | 2,3574 | ,5271 |
| VAR003 | kanan | 20 | 6,2184 | 1,6483 | ,3686 |
| | kiri | 20 | 6,8189 | ,9976 | ,2231 |
| VAR004 | kanan | 20 | 3,7719 | ,8566 | ,1915 |
| | kiri | 20 | 4,0838 | ,5320 | ,1190 |
| VAR005 | kanan | 20 | 2,4982 | ,6628 | ,1482 |
| | kiri | 20 | 2,5219 | ,5085 | ,1137 |
| VAR006 | kanan | 20 | 1,6000 | ,6007 | ,1343 |
| | kiri | 20 | 1,8586 | ,6294 | ,1407 |
| VAR007 | kanan | 20 | 1,3511 | ,6074 | ,1358 |
| | kiri | 20 | 1,5059 | ,5587 | ,1249 |
| VAR008 | kanan | 20 | 1,1790 | ,3970 | 8,877E-02 |
| | kiri | 20 | 1,1961 | ,3944 | 8,818E-02 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR001 | Equal variances assumed | 8,069 | ,007 | 2,168 | 38 | ,037 | 3,9013 | 1,7997 |
| | Equal variances not assumed | | | 2,168 | 27,494 | ,039 | 3,9013 | 1,7997 |
| VAR002 | Equal variances assumed | 1,621 | ,211 | -,974 | 38 | ,336 | -,9659 | ,9921 |
| | Equal variances not assumed | | | -,974 | 31,943 | ,338 | -,9659 | ,9921 |
| VAR003 | Equal variances assumed | 3,422 | ,072 | -1,394 | 38 | ,171 | -,6005 | ,4308 |
| | Equal variances not assumed | | | -1,394 | 31,272 | ,173 | -,6005 | ,4308 |
| VAR004 | Equal variances assumed | 8,193 | ,007 | -1,383 | 38 | ,175 | -,3119 | ,2255 |
| | Equal variances not assumed | | | -1,383 | 31,760 | ,176 | -,3119 | ,2255 |
| VAR005 | Equal variances assumed | 2,811 | ,102 | -,127 | 38 | ,900 | -2,E-02 | ,1868 |
| | Equal variances not assumed | | | -,127 | 35,612 | ,900 | -2,E-02 | ,1868 |
| VAR006 | Equal variances assumed | ,091 | ,765 | -1,329 | 38 | ,192 | -,2586 | ,1946 |
| | Equal variances not assumed | | | -1,329 | 37,918 | ,192 | -,2586 | ,1946 |
| VAR007 | Equal variances assumed | ,384 | ,539 | -,839 | 38 | ,407 | -,1548 | ,1845 |
| | Equal variances not assumed | | | -,839 | 37,738 | ,407 | -,1548 | ,1845 |
| VAR008 | Equal variances assumed | ,234 | ,631 | -,137 | 38 | ,892 | -2,E-02 | ,1251 |
| | Equal variances not assumed | | | -,137 | 37,998 | ,892 | -2,E-02 | ,1251 |

## T-Test

**Group Statistics**

| | LOKASI | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR009 | kanan | 20 | ,8425 | ,3386 | 7,571E-02 |
| | kiri | 20 | 1,0595 | ,2195 | 4,907E-02 |
| VAR010 | kanan | 20 | ,7768 | ,2947 | 6,589E-02 |
| | kiri | 20 | ,8682 | ,2219 | 4,963E-02 |
| VAR011 | kanan | 20 | ,7154 | ,2215 | 4,953E-02 |
| | kiri | 20 | ,7083 | ,1900 | 4,249E-02 |
| VAR012 | kanan | 20 | ,6933 | ,1827 | 4,085E-02 |
| | kiri | 20 | ,6563 | ,2005 | 4,484E-02 |
| VAR013 | kanan | 20 | ,5995 | ,2074 | 4,637E-02 |
| | kiri | 20 | ,5847 | ,1830 | 4,093E-02 |
| VAR014 | kanan | 20 | ,5255 | ,2400 | 5,366E-02 |
| | kiri | 20 | ,6297 | ,1649 | 3,688E-02 |
| VAR015 | kanan | 20 | ,4954 | ,2087 | 4,667E-02 |
| | kiri | 20 | ,6147 | ,1759 | 3,933E-02 |
| VAR016 | kanan | 20 | -,2916 | ,1088 | 2,433E-02 |
| | kiri | 20 | -,2950 | 9,935E-02 | 2,221E-02 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR009 | Equal variances assumed | 8,433 | ,006 | -2,405 | 38 | ,021 | -,2170 | ,0902 |
| | Equal variances not assumed | | | -2,405 | 32,57 | ,022 | -,2170 | ,0902 |
| VAR010 | Equal variances assumed | ,189 | ,666 | -1,108 | 38 | ,275 | -,0914 | ,0825 |
| | Equal variances not assumed | | | -1,108 | 35,31 | ,275 | -,0914 | ,0825 |
| VAR011 | Equal variances assumed | ,145 | ,706 | ,109 | 38 | ,913 | 7,E-03 | ,0653 |
| | Equal variances not assumed | | | ,109 | 37,14 | ,913 | 7,E-03 | ,0653 |
| VAR012 | Equal variances assumed | ,120 | ,731 | ,609 | 38 | ,546 | 4,E-02 | ,0607 |
| | Equal variances not assumed | | | ,609 | 37,67 | ,546 | 4,E-02 | ,0607 |
| VAR013 | Equal variances assumed | ,810 | ,374 | ,240 | 38 | ,812 | 1,E-02 | ,0618 |
| | Equal variances not assumed | | | ,240 | 37,42 | ,812 | 1,E-02 | ,0618 |
| VAR014 | Equal variances assumed | 1,434 | ,239 | -1,600 | 38 | ,118 | -,1042 | ,0651 |
| | Equal variances not assumed | | | -1,600 | 33,68 | ,119 | -,1042 | ,0651 |
| VAR015 | Equal variances assumed | ,217 | ,644 | -1,954 | 38 | ,058 | -,1193 | ,0610 |
| | Equal variances not assumed | | | -1,954 | 36,94 | ,058 | -,1193 | ,0610 |
| VAR016 | Equal variances assumed | ,122 | ,728 | ,102 | 38 | ,919 | 3,E-03 | ,0329 |
| | Equal variances not assumed | | | ,102 | 37,69 | ,919 | 3,E-03 | ,0329 |

# Oneway

**Descriptives**

Discriminant Scores from Function 1 for Analysis 1

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| kanan | 20 | -,3803332 | 1,1867498 | ,2653653 | -,9357492 | ,1750828 |
| kiri | 20 | ,3803332 | ,7691716 | ,1719920 | 2,03E-02 | ,7403166 |
| Total | 40 | 4,00E-16 | 1,0595855 | ,1675352 | -,3388719 | ,3388719 |

**Test of Homogeneity of Variances**

Discriminant Scores from Function 1 for Analysis 1

| Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|
| 8,433 | 1 | 38 | ,006 |

**ANOVA**

Discriminant Scores from Function 1 for Analysis 1

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 5,786 | 1 | 5,786 | 5,786 | ,021 |
| Within Groups | 38,000 | 38 | 1,000 | | |
| Total | 43,786 | 39 | | | |

# Analisis statistik untuk quadran *c* (Gambar 4.6.) kanan dibandingkan dengan yang kiri

## Discriminant

**Analysis Case Processing Summary**

| Unweighted Cases | | N | Percent |
|---|---|---|---|
| Valid | | 40 | 66,7 |
| Excluded | Missing or out-of-range group codes | 0 | ,0 |
| | At least one missing discriminating variable | 0 | ,0 |
| | Both missing or out-of-range group codes and at least one missing discriminating variable | 20 | 33,3 |
| | Total | 20 | 33,3 |
| Total | | 60 | 100,0 |

**Group Statistics**

| lokasi | | Mean | Std. Deviation | Valid N (listwise) Unweighted | Valid N (listwise) Weighted |
|---|---|---|---|---|---|
| kanan | VAR001 | 60,8185 | 5,7905 | 20 | 20,000 |
| | VAR002 | 16,5320 | 2,9998 | 20 | 20,000 |
| | VAR003 | 7,5545 | 1,6928 | 20 | 20,000 |
| | VAR004 | 4,4640 | 1,0717 | 20 | 20,000 |
| | VAR005 | 2,9366 | ,7185 | 20 | 20,000 |
| | VAR006 | 2,2161 | ,4961 | 20 | 20,000 |
| | VAR007 | 1,7419 | ,4967 | 20 | 20,000 |
| | VAR008 | 1,2170 | ,5075 | 20 | 20,000 |
| | VAR009 | 1,0747 | ,2976 | 20 | 20,000 |
| | VAR010 | ,9447 | ,2756 | 20 | 20,000 |
| | VAR011 | ,7910 | ,2530 | 20 | 20,000 |
| | VAR012 | ,7805 | ,1960 | 20 | 20,000 |
| | VAR013 | ,7352 | ,2025 | 20 | 20,000 |
| | VAR014 | ,7492 | ,2021 | 20 | 20,000 |
| | VAR015 | ,6828 | ,1952 | 20 | 20,000 |
| | VAR016 | -,3366 | ,1517 | 20 | 20,000 |
| kiri | VAR001 | 62,3909 | 6,0649 | 20 | 20,000 |
| | VAR002 | 15,8824 | 2,4733 | 20 | 20,000 |
| | VAR003 | 7,0659 | 1,4502 | 20 | 20,000 |
| | VAR004 | 4,3565 | ,6031 | 20 | 20,000 |
| | VAR005 | 2,6690 | ,5486 | 20 | 20,000 |
| | VAR006 | 2,0138 | ,5623 | 20 | 20,000 |
| | VAR007 | 1,7037 | ,4606 | 20 | 20,000 |
| | VAR008 | 1,1426 | ,3559 | 20 | 20,000 |
| | VAR009 | 1,0866 | ,2701 | 20 | 20,000 |
| | VAR010 | 1,0087 | ,2609 | 20 | 20,000 |
| | VAR011 | ,8443 | ,2267 | 20 | 20,000 |
| | VAR012 | ,7425 | ,2747 | 20 | 20,000 |
| | VAR013 | ,6648 | ,2199 | 20 | 20,000 |
| | VAR014 | ,7091 | ,2107 | 20 | 20,000 |
| | VAR015 | ,6155 | ,1868 | 20 | 20,000 |
| | VAR016 | -,2917 | ,1040 | 20 | 20,000 |
| Total | VAR001 | 61,6047 | 5,9067 | 40 | 40,000 |
| | VAR002 | 16,2072 | 2,7336 | 40 | 40,000 |
| | VAR003 | 7,3102 | 1,5754 | 40 | 40,000 |
| | VAR004 | 4,4102 | ,8601 | 40 | 40,000 |
| | VAR005 | 2,8028 | ,6454 | 40 | 40,000 |
| | VAR006 | 2,1150 | ,5333 | 40 | 40,000 |
| | VAR007 | 1,7228 | ,4732 | 40 | 40,000 |
| | VAR008 | 1,1798 | ,4343 | 40 | 40,000 |
| | VAR009 | 1,0807 | ,2806 | 40 | 40,000 |
| | VAR010 | ,9767 | ,2668 | 40 | 40,000 |
| | VAR011 | ,8177 | ,2386 | 40 | 40,000 |
| | VAR012 | ,7615 | ,2363 | 40 | 40,000 |
| | VAR013 | ,7000 | ,2117 | 40 | 40,000 |
| | VAR014 | ,7291 | ,2048 | 40 | 40,000 |
| | VAR015 | ,6492 | ,1916 | 40 | 40,000 |

**Tests of Equality of Group Means**

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| VAR001 | ,982 | ,703 | 1 | 38 | ,407 |
| VAR002 | ,986 | ,558 | 1 | 38 | ,460 |
| VAR003 | ,975 | ,961 | 1 | 38 | ,333 |
| VAR004 | ,996 | ,153 | 1 | 38 | ,698 |
| VAR005 | ,956 | 1,752 | 1 | 38 | ,194 |
| VAR006 | ,963 | 1,455 | 1 | 38 | ,235 |
| VAR007 | ,998 | ,064 | 1 | 38 | ,802 |
| VAR008 | ,992 | ,288 | 1 | 38 | ,594 |
| VAR009 | 1,000 | ,017 | 1 | 38 | ,896 |
| VAR010 | ,985 | ,569 | 1 | 38 | ,455 |
| VAR011 | ,987 | ,491 | 1 | 38 | ,488 |
| VAR012 | ,993 | ,253 | 1 | 38 | ,618 |
| VAR013 | ,972 | 1,107 | 1 | 38 | ,299 |
| VAR014 | ,990 | ,378 | 1 | 38 | ,543 |
| VAR015 | ,968 | 1,240 | 1 | 38 | ,272 |
| VAR016 | ,970 | 1,189 | 1 | 38 | ,282 |

# Analysis 1
# Stepwise Statistics

**Variables Entered/Removed[a,b,c]**

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 32.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

e. No variables are qualified for the analysis.

**Variables in the Analysis**

**Variables Not in the Analysis**

| Step | | Tolerance | Min. Tolerance | F to Enter | Min. D Squared | Between Groups |
|---|---|---|---|---|---|---|
| 0 | VAR001 | 1,000 | 1,000 | ,703 | ,070 | kanan and kiri |
| | VAR002 | 1,000 | 1,000 | ,558 | ,056 | kanan and kiri |
| | VAR003 | 1,000 | 1,000 | ,961 | ,096 | kanan and kiri |
| | VAR004 | 1,000 | 1,000 | ,153 | ,015 | kanan and kiri |
| | VAR005 | 1,000 | 1,000 | 1,752 | ,175 | kanan and kiri |
| | VAR006 | 1,000 | 1,000 | 1,455 | ,146 | kanan and kiri |
| | VAR007 | 1,000 | 1,000 | ,064 | ,006 | kanan and kiri |
| | VAR008 | 1,000 | 1,000 | ,288 | ,029 | kanan and kiri |
| | VAR009 | 1,000 | 1,000 | ,017 | ,002 | kanan and kiri |
| | VAR010 | 1,000 | 1,000 | ,569 | ,057 | kanan and kiri |
| | VAR011 | 1,000 | 1,000 | ,491 | ,049 | kanan and kiri |
| | VAR012 | 1,000 | 1,000 | ,253 | ,025 | kanan and kiri |
| | VAR013 | 1,000 | 1,000 | 1,107 | ,111 | kanan and kiri |
| | VAR014 | 1,000 | 1,000 | ,378 | ,038 | kanan and kiri |
| | VAR015 | 1,000 | 1,000 | 1,240 | ,124 | kanan and kiri |
| | VAR016 | 1,000 | 1,000 | 1,189 | ,119 | kanan and kiri |

**Wilks' Lambda[a]**

a. No variables are qualified for the analysis.

## T-Test

**Group Statistics**

| | lokasi | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR001 | kanan | 20 | 60,8185 | 5,7905 | 1,2948 |
| | kiri | 20 | 62,3909 | 6,0649 | 1,3562 |
| VAR002 | kanan | 20 | 16,5320 | 2,9998 | ,6708 |
| | kiri | 20 | 15,8824 | 2,4733 | ,5530 |
| VAR003 | kanan | 20 | 7,5545 | 1,6928 | ,3785 |
| | kiri | 20 | 7,0659 | 1,4502 | ,3243 |
| VAR004 | kanan | 20 | 4,4640 | 1,0717 | ,2396 |
| | kiri | 20 | 4,3565 | ,6031 | ,1349 |
| VAR005 | kanan | 20 | 2,9366 | ,7185 | ,1607 |
| | kiri | 20 | 2,6690 | ,5486 | ,1227 |
| VAR006 | kanan | 20 | 2,2161 | ,4961 | ,1109 |
| | kiri | 20 | 2,0138 | ,5623 | ,1257 |
| VAR007 | kanan | 20 | 1,7419 | ,4967 | ,1111 |
| | kiri | 20 | 1,7037 | ,4606 | ,1030 |
| VAR008 | kanan | 20 | 1,2170 | ,5075 | ,1135 |
| | kiri | 20 | 1,1426 | ,3559 | 7,957E-02 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR001 | Equal variances assumed | ,001 | ,982 | -,839 | 38 | ,407 | -1,5724 | 1,8750 |
| | Equal variances not assumed | | | -,839 | 37,919 | ,407 | -1,5724 | 1,8750 |
| VAR002 | Equal variances assumed | ,034 | ,854 | ,747 | 38 | ,460 | ,6495 | ,8694 |
| | Equal variances not assumed | | | .747 | 36.667 | .460 | .6495 | .8694 |
| VAR003 | Equal variances assumed | ,311 | ,580 | ,980 | 38 | ,333 | ,4886 | ,4984 |
| | Equal variances not assumed | | | ,980 | 37,126 | ,333 | ,4886 | ,4984 |
| VAR004 | Equal variances assumed | 1,743 | ,195 | ,391 | 38 | ,698 | ,1075 | ,2750 |
| | Equal variances not assumed | | | ,391 | 29,938 | ,699 | ,1075 | ,2750 |
| VAR005 | Equal variances assumed | 1,056 | ,311 | 1,323 | 38 | ,194 | ,2675 | ,2021 |
| | Equal variances not assumed | | | 1,323 | 35,535 | ,194 | ,2675 | ,2021 |
| VAR006 | Equal variances assumed | ,139 | ,711 | 1,206 | 38 | ,235 | ,2023 | ,1677 |
| | Equal variances not assumed | | | 1,206 | 37,418 | ,235 | ,2023 | ,1677 |
| VAR007 | Equal variances assumed | ,000 | ,993 | ,253 | 38 | ,802 | 4,E-02 | ,1515 |
| | Equal variances not assumed | | | ,253 | 37,786 | ,802 | 4,E-02 | ,1515 |
| VAR008 | Equal variances assumed | 4,388 | ,043 | ,537 | 38 | ,594 | 7,E-02 | ,1386 |
| | Equal variances not assumed | | | ,537 | 34,048 | ,595 | 7,E-02 | ,1386 |

## T-Test

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR009 | Equal variances assumed | ,043 | ,836 | -,132 | 38 | ,896 | -1,E-02 | 9,E-02 |
| | Equal variances not assumed | | | -,132 | 37,646 | ,896 | -1,E-02 | 9,E-02 |
| VAR010 | Equal variances assumed | ,040 | ,843 | -,754 | 38 | ,455 | -6,E-02 | 8,E-02 |
| | Equal variances not assumed | | | -,754 | 37,887 | ,455 | -6,E-02 | 8,E-02 |
| VAR011 | Equal variances assumed | ,192 | ,664 | -,701 | 38 | ,488 | -5,E-02 | 8,E-02 |
| | Equal variances not assumed | | | -,701 | 37,551 | ,488 | -5,E-02 | 8,E-02 |
| VAR012 | Equal variances assumed | 3,546 | ,067 | ,503 | 38 | ,618 | 3,8E-02 | 8,E-02 |
| | Equal variances not assumed | | | ,503 | 34,358 | ,618 | 3,8E-02 | 8,E-02 |
| VAR013 | Equal variances assumed | ,158 | ,694 | 1,052 | 38 | ,299 | 7,0E-02 | 7,E-02 |
| | Equal variances not assumed | | | 1,052 | 37,744 | ,299 | 7,0E-02 | 7,E-02 |
| VAR014 | Equal variances assumed | ,145 | ,706 | ,615 | 38 | ,543 | 4,0E-02 | 7,E-02 |
| | Equal variances not assumed | | | ,615 | 37,935 | ,543 | 4,0E-02 | 7,E-02 |
| VAR015 | Equal variances assumed | ,080 | ,779 | 1,114 | 38 | ,272 | 6,7E-02 | 6,E-02 |
| | Equal variances not assumed | | | 1,114 | 37,927 | ,272 | 6,7E-02 | 6,E-02 |
| VAR016 | Equal variances assumed | 2,247 | ,142 | -1,090 | 38 | ,282 | -4,E-02 | 4,E-02 |
| | Equal variances not assumed | | | -1,090 | 33,637 | ,283 | -4,E-02 | 4,E-02 |

**Group Statistics**

| | lokasi | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR009 | kanan | 20 | 1,0747 | ,2976 | 6,655E-02 |
| | kiri | 20 | 1,0866 | ,2701 | 6,039E-02 |
| VAR010 | kanan | 20 | ,9447 | ,2756 | 6,162E-02 |
| | kiri | 20 | 1,0087 | ,2609 | 5,834E-02 |
| VAR011 | kanan | 20 | ,7910 | ,2530 | 5,657E-02 |
| | kiri | 20 | ,8443 | ,2267 | 5,069E-02 |
| VAR012 | kanan | 20 | ,7805 | ,1960 | 4,382E-02 |
| | kiri | 20 | ,7425 | ,2747 | 6,144E-02 |
| VAR013 | kanan | 20 | ,7352 | ,2025 | 4,528E-02 |
| | kiri | 20 | ,6648 | ,2199 | 4,917E-02 |
| VAR014 | kanan | 20 | ,7492 | ,2021 | 4,519E-02 |
| | kiri | 20 | ,7091 | ,2107 | 4,710E-02 |
| VAR015 | kanan | 20 | ,6828 | ,1952 | 4,364E-02 |
| | kiri | 20 | ,6155 | ,1868 | 4,177E-02 |
| VAR016 | kanan | 20 | -,3366 | ,1517 | 3,392E-02 |
| | kiri | 20 | -,2917 | ,1040 | 2,326E-02 |

# Analisis statistik untuk quadran *d* (Gambar 4.6.) kanan dibandingkan dengan yang kiri

## Discriminant

**Warnings**

| |
|---|
| All-Groups Stacked Histogram is no longer displayed. |

**Analysis Case Processing Summary**

| Unweighted Cases | | N | Percent |
|---|---|---|---|
| Valid | | 40 | 100,0 |
| Excluded | Missing or out-of-range group codes | 0 | ,0 |
| | At least one missing discriminating variable | 0 | ,0 |
| | Both missing or out-of-range group codes and at least one missing discriminating variable | 0 | ,0 |
| | Total | 0 | ,0 |
| Total | | 40 | 100,0 |

**Group Statistics**

| lokasi | | Mean | Std. Deviation | Valid N (listwise) Unweighted | Valid N (listwise) Weighted |
|---|---|---|---|---|---|
| kanan | VAR001 | 60,9001 | 5,0028 | 20 | 20,000 |
| | VAR002 | 16,0788 | 2,7841 | 20 | 20,000 |
| | VAR003 | 7,3126 | 1,4642 | 20 | 20,000 |
| | VAR004 | 4,2906 | ,7018 | 20 | 20,000 |
| | VAR005 | 2,9400 | ,5675 | 20 | 20,000 |
| | VAR006 | 2,1090 | ,5687 | 20 | 20,000 |
| | VAR007 | 1,6070 | ,5820 | 20 | 20,000 |
| | VAR008 | 1,3947 | ,5439 | 20 | 20,000 |
| | VAR009 | 1,2907 | ,3093 | 20 | 20,000 |
| | VAR010 | 1,0972 | ,2681 | 20 | 20,000 |
| | VAR011 | 1,0174 | ,2350 | 20 | 20,000 |
| | VAR012 | ,8861 | ,2215 | 20 | 20,000 |
| | VAR013 | ,8540 | ,2188 | 20 | 20,000 |
| | VAR014 | ,7604 | ,2066 | 20 | 20,000 |
| | VAR015 | ,7784 | ,2907 | 20 | 20,000 |
| | VAR016 | -,3501 | ,1512 | 20 | 20,000 |
| kiri | VAR001 | 62,7955 | 6,0573 | 20 | 20,000 |
| | VAR002 | 15,4668 | 2,7304 | 20 | 20,000 |
| | VAR003 | 7,2048 | 1,4327 | 20 | 20,000 |
| | VAR004 | 4,4487 | ,6244 | 20 | 20,000 |
| | VAR005 | 2,8631 | ,5716 | 20 | 20,000 |
| | VAR006 | 2,1634 | ,3847 | 20 | 20,000 |
| | VAR007 | 1,7368 | ,5141 | 20 | 20,000 |
| | VAR008 | 1,3902 | ,4563 | 20 | 20,000 |
| | VAR009 | 1,2240 | ,3373 | 20 | 20,000 |
| | VAR010 | 1,0184 | ,2458 | 20 | 20,000 |
| | VAR011 | ,8708 | ,2518 | 20 | 20,000 |
| | VAR012 | ,8114 | ,1799 | 20 | 20,000 |
| | VAR013 | ,7225 | ,1711 | 20 | 20,000 |
| | VAR014 | ,7405 | ,1953 | 20 | 20,000 |
| | VAR015 | ,6584 | ,1621 | 20 | 20,000 |
| | VAR016 | -,3342 | ,1007 | 20 | 20,000 |
| Total | VAR001 | 61,8478 | 5,5668 | 40 | 40,000 |
| | VAR002 | 15,7728 | 2,7394 | 40 | 40,000 |
| | VAR003 | 7,2587 | 1,4309 | 40 | 40,000 |
| | VAR004 | 4,3696 | ,6605 | 40 | 40,000 |
| | VAR005 | 2,9016 | ,5635 | 40 | 40,000 |
| | VAR006 | 2,1362 | ,4800 | 40 | 40,000 |
| | VAR007 | 1,6719 | ,5460 | 40 | 40,000 |
| | VAR008 | 1,3924 | ,4955 | 40 | 40,000 |
| | VAR009 | 1,2574 | ,3212 | 40 | 40,000 |
| | VAR010 | 1,0578 | ,2570 | 40 | 40,000 |
| | VAR011 | ,9441 | ,2516 | 40 | 40,000 |
| | VAR012 | ,8487 | ,2028 | 40 | 40,000 |
| | VAR013 | ,7882 | ,2050 | 40 | 40,000 |
| | VAR014 | ,7505 | ,1987 | 40 | 40,000 |
| | VAR015 | ,7184 | ,2401 | 40 | 40,000 |
| | VAR016 | -,3422 | ,1270 | 40 | 40,000 |

**Tests of Equality of Group Means**

| | Wilks' Lambda | F | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| VAR001 | ,970 | 1,164 | 1 | 38 | ,287 |
| VAR002 | ,987 | ,493 | 1 | 38 | ,487 |
| VAR003 | ,999 | ,055 | 1 | 38 | ,815 |
| VAR004 | ,985 | ,567 | 1 | 38 | ,456 |
| VAR005 | ,995 | ,182 | 1 | 38 | ,672 |
| VAR006 | ,997 | ,126 | 1 | 38 | ,725 |
| VAR007 | ,986 | ,559 | 1 | 38 | ,459 |
| VAR008 | 1,000 | ,001 | 1 | 38 | ,978 |
| VAR009 | ,989 | ,425 | 1 | 38 | ,518 |
| VAR010 | ,976 | ,939 | 1 | 38 | ,339 |
| VAR011 | ,913 | 3,621 | 1 | 38 | ,065 |
| VAR012 | ,965 | 1,370 | 1 | 38 | ,249 |
| VAR013 | ,894 | 4,484 | 1 | 38 | ,041 |
| VAR014 | ,997 | ,097 | 1 | 38 | ,757 |
| VAR015 | ,936 | 2,600 | 1 | 38 | ,115 |
| VAR016 | ,996 | ,153 | 1 | 38 | ,698 |

# Analysis 1
# Stepwise Statistics

**Variables Entered/Removed[a,b,c,d]**

| Step | Entered | Min. D Squared | | | | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | Between Groups | Exact F | | | |
| | | | | Statistic | df1 | df2 | Sig. |
| 1 | VAR013 | ,448 | kanan and kiri | 4,484 | 1 | 38,000 | 4,082E-02 |

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 32.

b. Minimum partial F to enter is 3.84.

c. Maximum partial F to remove is 2.71.

d. F level, tolerance, or VIN insufficient for further computation.

**Variables in the Analysis**

| Step | | Tolerance | F to Remove |
|---|---|---|---|
| 1 | VAR013 | 1,000 | 4,484 |

**Variables Not in the Analysis**

| Step | | Tolerance | Min. Tolerance | F to Enter | Min. D Squared | Between Groups |
|---|---|---|---|---|---|---|
| 0 | VAR001 | 1,000 | 1,000 | 1,164 | ,116 | kanan and kiri |
| | VAR002 | 1,000 | 1,000 | ,493 | ,049 | kanan and kiri |
| | VAR003 | 1,000 | 1,000 | ,055 | ,006 | kanan and kiri |
| | VAR004 | 1,000 | 1,000 | ,567 | ,057 | kanan and kiri |
| | VAR005 | 1,000 | 1,000 | ,182 | ,018 | kanan and kiri |
| | VAR006 | 1,000 | 1,000 | ,126 | ,013 | kanan and kiri |
| | VAR007 | 1,000 | 1,000 | ,559 | ,056 | kanan and kiri |
| | VAR008 | 1,000 | 1,000 | ,001 | ,000 | kanan and kiri |
| | VAR009 | 1,000 | 1,000 | ,425 | ,042 | kanan and kiri |
| | VAR010 | 1,000 | 1,000 | ,939 | ,094 | kanan and kiri |
| | VAR011 | 1,000 | 1,000 | 3,621 | ,362 | kanan and kiri |
| | VAR012 | 1,000 | 1,000 | 1,370 | ,137 | kanan and kiri |
| | VAR013 | 1,000 | 1,000 | 4,484 | ,448 | kanan and kiri |
| | VAR014 | 1,000 | 1,000 | ,097 | ,010 | kanan and kiri |
| | VAR015 | 1,000 | 1,000 | 2,600 | ,260 | kanan and kiri |
| | VAR016 | 1,000 | 1,000 | ,153 | ,015 | kanan and kiri |
| 1 | VAR001 | ,860 | ,860 | ,083 | ,458 | kanan and kiri |
| | VAR002 | ,999 | ,999 | ,370 | ,491 | kanan and kiri |
| | VAR003 | ,922 | ,922 | ,120 | ,462 | kanan and kiri |
| | VAR004 | ,977 | ,977 | 1,023 | ,566 | kanan and kiri |
| | VAR005 | ,954 | ,954 | ,001 | ,448 | kanan and kiri |
| | VAR006 | ,967 | ,967 | ,489 | ,505 | kanan and kiri |
| | VAR007 | ,927 | ,927 | 1,635 | ,636 | kanan and kiri |
| | VAR008 | ,989 | ,989 | ,034 | ,452 | kanan and kiri |
| | VAR009 | ,910 | ,910 | ,000 | ,448 | kanan and kiri |
| | VAR010 | ,722 | ,722 | ,026 | ,451 | kanan and kiri |
| | VAR011 | ,576 | ,576 | ,416 | ,496 | kanan and kiri |

**Wilks' Lambda**

| Step | Number of Variables | Lambda | df1 | df2 | df3 | Exact F | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Statistic | df1 | df2 | Sig. |
| 1 | 1 | ,894 | 1 | 1 | 38 | 4,484 | 1 | 38,000 | 4,082E-02 |

# Summary of Canonical Discriminant Functions

**Eigenvalues**

| Function | Eigenvalue | % of Variance | Cumulative % | Canonical Correlation |
|---|---|---|---|---|
| 1 | ,118[a] | 100,0 | 100,0 | ,325 |

a. First 1 canonical discriminant functions were used in the analysis.

**Wilks' Lambda**

| Test of Function(s) | Wilks' Lambda | Chi-square | df | Sig. |
|---|---|---|---|---|
| 1 | ,894 | 4,183 | 1 | ,041 |

**Standardized Canonical Discriminant Function Coefficients**

| | Function |
|---|---|
| | 1 |
| VAR013 | 1,000 |

**Structure Matrix**

| | Function |
|---|---|
| | 1 |
| VAR013 | 1,000 |
| VAR012[a] | ,714 |
| VAR014[a] | ,698 |
| VAR015[a] | ,694 |
| VAR011[a] | ,651 |
| VAR016[a] | -,559 |
| VAR010[a] | ,527 |
| VAR001[a] | -,374 |
| VAR009[a] | ,300 |
| VAR003[a] | ,279 |
| VAR007[a] | ,270 |
| VAR005[a] | ,214 |
| VAR006[a] | ,181 |
| VAR004[a] | ,150 |
| VAR008[a] | ,106 |
| VAR002[a] | ,024 |

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

**Canonical Discriminant Function Coefficients**

| | Function |
|---|---|
| | 1 |
| VAR013 | 5,092 |
| (Constant) | -4,013 |

Unstandardized coefficients

**Functions at Group Centroids**

| | Function |
|---|---|
| lokasi | 1 |
| kanan | ,335 |
| kiri | -,335 |

Unstandardized canonical discriminant functions evaluated at group means

# Classification Statistics

**Classification Processing Summary**

| | | |
|---|---|---|
| Processed | | 40 |
| Excluded | Missing or out-of-range group codes | 0 |
| | At least one missing discriminating variable | 0 |
| Used in Output | | 40 |

**Prior Probabilities for Groups**

| lokasi | Prior | Cases Used in Analysis | |
|---|---|---|---|
| | | Unweighted | Weighted |
| kanan | ,500 | 20 | 20,000 |
| kiri | ,500 | 20 | 20,000 |
| Total | 1,000 | 40 | 40,000 |

**Classification Function Coefficients**

| | lokasi | |
|---|---|---|
| | kanan | kiri |
| VAR013 | 22,140 | 18,730 |
| (Constant) | -10,147 | -7,459 |

Fisher's linear discriminant functions

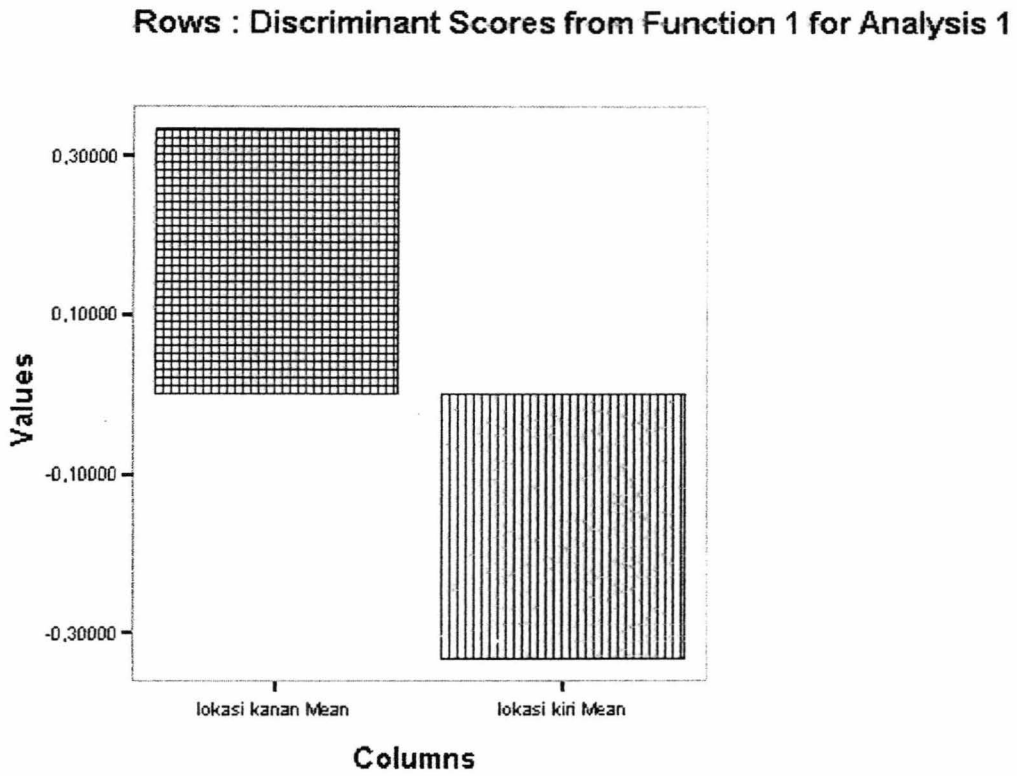
**Classification Results[a]**

| | | lokasi | Predicted Group Membership | | Total |
|---|---|---|---|---|---|
| | | | kanan | kiri | |
| Original | Count | kanan | 12 | 8 | 20 |
| | | kiri | 8 | 12 | 20 |
| | % | kanan | 60,0 | 40,0 | 100,0 |
| | | kiri | 40,0 | 60,0 | 100,0 |

a. 60,0% of original grouped cases correctly classified.

## Tables

| | lokasi | |
|---|---|---|
| | kanan | kiri |
| | Mean | Mean |
| Discriminant Scores from Function 1 for Analysis 1 | ,33481 | -,33481 |




## T-Test

**Group Statistics**

| | lokasi | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR001 | kanan | 20 | 60,9001 | 5,0028 | 1,1187 |
| | kiri | 20 | 62,7955 | 6,0573 | 1,3545 |
| VAR002 | kanan | 20 | 16,0788 | 2,7841 | ,6225 |
| | kiri | 20 | 15,4668 | 2,7304 | ,6105 |
| VAR003 | kanan | 20 | 7,3126 | 1,4642 | ,3274 |
| | kiri | 20 | 7,2048 | 1,4327 | ,3204 |
| VAR004 | kanan | 20 | 4,2906 | ,7018 | ,1569 |
| | kiri | 20 | 4,4487 | ,6244 | ,1396 |
| VAR005 | kanan | 20 | 2,9400 | ,5675 | ,1269 |
| | kiri | 20 | 2,8631 | ,5716 | ,1278 |
| VAR006 | kanan | 20 | 2,1090 | ,5687 | ,1272 |
| | kiri | 20 | 2,1634 | ,3847 | 8,601E-02 |
| VAR007 | kanan | 20 | 1,6070 | ,5820 | ,1301 |
| | kiri | 20 | 1,7368 | ,5141 | ,1149 |
| VAR008 | kanan | 20 | 1,3947 | ,5439 | ,1216 |
| | kiri | 20 | 1,3902 | ,4563 | ,1020 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR001 | Equal variances assumed | ,734 | ,397 | -1,079 | 38 | ,287 | -1,8954 | 1,7567 |
| | Equal variances not assumed | | | -1,079 | 36,69 | ,288 | -1,8954 | 1,7567 |
| VAR002 | Equal variances assumed | ,230 | ,634 | ,702 | 38 | ,487 | ,6121 | ,8720 |
| | Equal variances not assumed | | | 702 | 37,99 | ,487 | ,6121 | ,8720 |
| VAR003 | Equal variances assumed | ,021 | ,885 | ,235 | 38 | ,815 | ,1078 | ,4581 |
| | Equal variances not assumed | | | ,235 | 37,98 | ,815 | ,1078 | ,4581 |
| VAR004 | Equal variances assumed | ,004 | ,950 | -,753 | 38 | ,456 | -,1581 | ,2100 |
| | Equal variances not assumed | | | -,753 | 37,49 | ,456 | -,1581 | ,2100 |
| VAR005 | Equal variances assumed | ,052 | ,821 | ,427 | 38 | ,672 | 7,7E-02 | ,1801 |
| | Equal variances not assumed | | | ,427 | 38,00 | ,672 | 7,7E-02 | ,1801 |
| VAR006 | Equal variances assumed | 1,54 | ,222 | -,354 | 38 | ,725 | -5,E-02 | ,1535 |
| | Equal variances not assumed | | | -,354 | 33,38 | ,725 | -5,E-02 | ,1535 |
| VAR007 | Equal variances assumed | ,744 | ,394 | -,747 | 38 | ,459 | -,1298 | ,1736 |
| | Equal variances not assumed | | | -,747 | 37,43 | ,460 | -,1298 | ,1736 |
| VAR008 | Equal variances assumed | 1,13 | ,295 | ,028 | 38 | ,978 | 4,4E-03 | ,1587 |
| | Equal variances not assumed | | | ,028 | 36,88 | ,978 | 4,4E-03 | ,1587 |

## T-Test

**Group Statistics**

| | lokasi | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| VAR009 | kanan | 20 | 1,2907 | ,3093 | 6,916E-02 |
| | kiri | 20 | 1,2240 | ,3373 | 7,542E-02 |
| VAR010 | kanan | 20 | 1,0972 | ,2681 | 5,995E-02 |
| | kiri | 20 | 1,0184 | ,2458 | 5,496E-02 |
| VAR011 | kanan | 20 | 1,0174 | ,2350 | 5,255E-02 |
| | kiri | 20 | ,8708 | ,2518 | 5,630E-02 |
| VAR012 | kanan | 20 | ,8861 | ,2215 | 4,954E-02 |
| | kiri | 20 | ,8114 | ,1799 | 4,023E-02 |
| VAR013 | kanan | 20 | ,8540 | ,2188 | 4,893E-02 |
| | kiri | 20 | ,7225 | ,1711 | 3,825E-02 |
| VAR014 | kanan | 20 | ,7604 | ,2066 | 4,619E-02 |
| | kiri | 20 | ,7405 | ,1953 | 4,367E-02 |
| VAR015 | kanan | 20 | ,7784 | ,2907 | 6,500E-02 |
| | kiri | 20 | ,6584 | ,1621 | 3,624E-02 |
| VAR016 | kanan | 20 | -,3501 | ,1512 | 3,381E-02 |
| | kiri | 20 | -,3342 | ,1007 | 2,251E-02 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | |
|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| VAR009 | Equal variances assumed | ,201 | ,657 | ,652 | 38 | ,518 | 7,E-02 | ,1023 |
| | Equal variances not assumed | | | ,652 | 37,719 | ,518 | 7,E-02 | ,1023 |
| VAR010 | Equal variances assumed | ,106 | ,747 | ,969 | 38 | ,339 | 8,E-02 | 8,1E-02 |
| | Equal variances not assumed | | | ,969 | 37,717 | ,339 | 8,E-02 | 8,1E-02 |
| VAR011 | Equal variances assumed | ,065 | ,800 | 1,903 | 38 | ,065 | ,1465 | 7,7E-02 |
| | Equal variances not assumed | | | 1,903 | 37,820 | ,065 | ,1465 | 7,7E-02 |
| VAR012 | Equal variances assumed | 1,847 | ,182 | 1,170 | 38 | ,249 | 7,E-02 | 6,4E-02 |
| | Equal variances not assumed | | | 1,170 | 36,467 | ,249 | 7,E-02 | 6,4E-02 |
| VAR013 | Equal variances assumed | ,966 | ,332 | 2,118 | 38 | ,041 | ,1315 | 6,2E-02 |
| | Equal variances not assumed | | | 2,118 | 35,911 | ,041 | ,1315 | 6,2E-02 |
| VAR014 | Equal variances assumed | ,116 | ,735 | ,312 | 38 | ,757 | 2,E-02 | 6,4E-02 |
| | Equal variances not assumed | | | ,312 | 37,880 | ,757 | 2,E-02 | 6,4E-02 |
| VAR015 | Equal variances assumed | 7,953 | ,008 | 1,613 | 38 | ,115 | ,1200 | 7,4E-02 |
| | Equal variances not assumed | | | 1,613 | 29,772 | ,117 | ,1200 | 7,4E-02 |
| VAR016 | Equal variances assumed | 2,003 | ,165 | -,391 | 38 | ,698 | -,0159 | 4,1E-02 |
| | Equal variances not assumed | | | -,391 | 33,078 | ,698 | -,0159 | 4,1E-02 |

# Oneway

**Descriptives**

Discriminant Scores from Function 1 for Analysis 1

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| kanan | 20 | ,3348074 | 1,1140923 | ,2491186 | -,1866039 | ,8562187 |
| kiri | 20 | -,3348074 | ,8710903 | ,1947817 | -,7424902 | 7,29E-02 |
| Total | 40 | -5,6E-16 | 1,0437094 | ,1650249 | -,3337944 | ,3337944 |

**Test of Homogeneity of Variances**

Discriminant Scores from Function 1 for Analysis 1

| Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|
| ,966 | 1 | 38 | ,332 |

**ANOVA**

Discriminant Scores from Function 1 for Analysis 1

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 4,484 | 1 | 4,484 | 4,484 | ,041 |
| Within Groups | 38,000 | 38 | 1,000 | | |
| Total | 42,484 | 39 | | | |