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# Effect of diet and dietary habits on Jaws of ancient and modern Population in Sudan

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**Abstract:** Background: The masticatory units are highly affected by diet and dietary habits which are reflected on the jaw size and occlusion. There are morphological differences between the modern population and ancient, like jaws of modern population are smaller, .and project less than those of equivalent sized ancient.

Aim: To determine the effect of diet and dietary habits on jaws size (width and length) in both modern and ancient.

Method: Across sectional study was done in Khartoum state, comparing ancient from Marawi (albejrawya) and modern population in Khartoum state. 44 samples, 22 jaws of ancient and 22 modern populations participate.

The 22 ancient remains were examined and measured directly, while the 22 modern participants filled the diet and dietary questioner then examined orally and the findings recorded on the examination sheet.

The jaws measurements for living were done on radiological (OPG&CBCT). Statistical analyses of the data set included univariate analysis to show the relative frequency distribution of each variable on the dental examination sheet.

Results: According to the result of overall the median of ancient jaw size maxilla vertical length was 2cm and modern population was1.4cm. The median length of mandible in ancient was 14.1cm
and modern population was 13.2cm. The width was 5.2cm in ancient mandible and 4.5cm in modern population mandible. The median width of maxilla ancient was 5.6cm and modern population was 5.3cm.

**Keywords:** Diet, Dietary Habits, Ancient Population, Current Population, Jaw Length and Jaw Width.

# تأثير النظام الغذائي والعادات الغذائية على فكي الإنسان قديماً وحديثاً في السودان

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**المستخلص:** تتأثر وحدات المضغ بشكل كبير بالنظام الغذائي والعادات الغذائية التي تنعكس على حجم الفك وانسداده. هناك اختلافات شكلية بين السكان المعاصرين والقدامى، مثل أن فكي السكان المعاصرين أصغر حجمًا، وتبرز بشكل أقل من فكي السكان القدامى المكافئين لهم في الحجم.

الهدف: تحديد تأثير النظام الغذائي والعادات الغذائية على حجم الفكين (العرض والطول) في العصر الحديث والقديم.

الطريقة: تم إجراء دراسة مقطعية في ولاية الخرطوم، لمقارنة السكان القدماء من مروي (البجراوية) والسكان المعاصرين في ولاية الخرطوم. شارك فيها 44 عينة و22 فكًا من السكان القدماء و22 من السكان المعاصرين.

تم فحص وقياس البقايا القديمة الـ 22 بشكل مباشر، بينما قام المشاركون الـ 22 المعاصرون بملء النظام الغذائي والمستفسر الغذائي ثم فحصهم شفهيًا وسجلت النتائج على ورقة الفحص.

تم إجراء القياسات الفكية للمعيشة على الأشعة (OPG&CBCT) تضمنت التحليلات الإحصائية لمجموعة البيانات تحليلًا أحادي المتغير لإظهار التوزيع التكراري النسبي لكل متغير في ورقة فحص الأسنان.

النتائج:وفقًا للنتيجة الإجمالية، كان متوسط حجم الفك القديم للطول الرأسي للفك العلوي 2 سم وكان عند السكان الحاليين 1.4 سم. كان متوسط طول الفك السفلي في العصور القديمة 14.1 سم أما حديثاً فكان 13.2 سم. كان العرض 5.2 سم في الفك السفلي القديم و4.5 سم في الفك السفلي الحديث. كان متوسط عرض الفك العلوي عند السكان القدماء 5.6 سم، وكان عند السكان الحاليين 5.3 سم.

**الكلمات المفتاحية:** النظام الغذائي، العادات الغذائية، السكان القدماء، السكان الحاليين، طول الفك وعرض الفك.

## Introduction:

The masticatory apparatus (the teeth, the jaws, temporomandibular joints and the muscles) workas harmonious functional unit in cutting and masticating food [(1)]. As well this apparatus like any biological system may respond to transient and permanent demands by certain adaptations functionally and structurally (2)

The use of tools and fire as part of human development has distinct effects on the jaws and dentition like decrease in the size of the masticatory system in the hominin which are acceptedto be the ancestors of Homo Sapiens [(3)]. Researchers have stated that this decrease was mostly due to the changes in the dietary habits of the species [(4).] There are morphological differences that separate the modern population from ancient, these include jaws of modern population are smaller, more ancient, and project less than those of equivalent sized ancient [(3).] In 2000 Schwartz, JH, Tattersall discovered protruding chin is one of the prominent features which differentiate modern people from our ancestors [(4).] Evidence for a role of the jaw muscles in shaping the face comes from animal studies showing that muscle ablations and experimental alteration of muscle function led to facial growth [(5).] From this research, we find that the nature of eating affects the size of the jaw and teeth by muscles activities. Studies reported that masticatory frequencies and eating times have decreased due to the appearance of soft modern foods, including processed foods, which can be swallowed and digested quickly [(6).] The decreased masticatory force due to the increased consumption of soft (primarily processed) foods could affect jawbone growth, resulting in malocclusion [(7).] Researcher studies on growing animals showed reduction in the mandibular s, and thinner condylar cartilage [(8).] Environmental factors such as masticatory muscles activities and the presence of oral habits also affect the jaws The modern diet does not offer the necessary effort in mastication, resulting in insufficient growth stimulation of jaws causing impacted and unerupted teeth. It has been suggested that themajor basic cause of aberrant/impacted teeth in the adults of developed nations is due to artificial feeding of babies, oral habits developed during childhood, cross breeding, excessive consumption of refined foods by the children and young individuals producing disproportion in the jaws and teeth [(9)]

## Materials and Methods

**1. study design**

Comparative cross-sectional study.

**2. study area**

The study was conducted in Khartoum state (the capital of Sudan).

**Sample size:**

Total coverage of the number of ancient skulls and jaws present in the museum of faculty of dentistry university of Khartoum collected from Marwi and equivalent number of patients attended with radiograph in Khartoum teaching dental hospital, which was 44 and who fulfilled the inclusion criteria.

Asimple random technique was used to select modern population.

**Data collection Tools:**

a. **Oral examination instruments**: Ruler, mirrors, probes, explorer, tweezers, dental chair, facemasks and gloves
b. **Data collection sheets:** Oral examination sheets and measurement sheets
c. **Examinable subjects:** Patient, Radiographs and Jaws (remains)

**Techniques and Analysis:**

The descriptive analysis was used to determine the frequency of diet intake and to determine the frequency, means, and standard deviation for each parameter (MXW, MXL, MW and ML) for the two groups and the compression between two groups.

Data were analyzed using the statistical package of the SPSS version 20. T test was used to compare differences between the values set at 0.05 and 0.01 confidence interval 95% and 99%. P values >0.05 and 0.01 were consider significant.

The benchmark range values of the parameters were determined by choosing the lowest value of the frequency distribution curve in the modern population and the highest value of the frequency distribution curve in the ancient.

## Results:

Table 1: People take vegetables in study participants (n=22):

| soft vegetables (n=22) | Number | % | Hard vegetables (n=22) | number | % |
|---|---|---|---|---|---|
| once per week | 1 | 4.5 | Do not take | 5 | 22.7 |
| two times per week | 1 | 4.5 | once per week | 2 | 9.1 |
| three times per week | 5 | 22.7 | two times per week | 2 | 9.1 |
| four times per week | 3 | 13.6 | three times per week | 5 | 22.7 |
| five times per week | 1 | 4.5 | four times per week | 1 | 4.5 |
| six times per week | 1 | 4.5 | six times per week | 1 | 4.5 |
| seven times per week | 10 | 45.5 | seven times per week | 6 | 27.3 |

Table 2: People take fruits in study participants (n=22):

| Soft fruit (n=22) | Number | % | Hard fruit (n=22) | Number | % |
|---|---|---|---|---|---|
| Do not take | 1 | 4.5 | do not take | 9 | 40.9 |
| once per week | 11 | 50.0 | once per week | 4 | 18.2 |
| two times per week | 3 | 13.6 | two times per week | 1 | 4.5 |
| three times per week | 3 | 13.6 | three times per week | 4 | 18.2 |
| five times per week | 1 | 4.5 | seven times per week | 4 | 18.2 |
| seven times per week | 3 | 13.6 | | | |

Table 3: People take meat in study participants (n=22):

| types of cooking meat (n=22) | number | % |
|---|---|---|
| Do not take | 1 | 4.5 |
| Fried | 1 | 4.5 |
| Grilled | 2 | 9.1 |
| Cooked | 6 | 27.3 |
| fried, grilled, cooked | 12 | 54.5 |

Table 4: jaws length (in ancient and modern population) in study participants (n=44):

| Variable (n=22) | Length Mandible Ancient | Length Mandible Modern | Vertical Length Maxilla Ancient | Vertical Length Maxilla Modern |
|---|---|---|---|---|
| Median | 14.1 | 13.2 | 2 | 1.4 |
| Std. Deviation | 1.84255 | 1.59138 | 0.29023 | 0.23966 |
| Minimum | 10 | 9 | 1.6 | 1 |
| Maximum | 16.5 | 14.3 | 2.5 | 1.8 |

Table 5: jaws width in ancient and modern population study participants (n=44):

| Variable (n=22) | Width Mandible Ancient | Width Mandible Modern | Width Maxilla Ancient | Width Maxilla Modern |
|---|---|---|---|---|
| Median | 5.2 | 4.5 | 5.6 | 5.3 |
| Std. Deviation | 0.95234 | 0.92481 | 1.10564 | 1.17746 |
| Minimum | 4.2 | 3.3 | 4.1 | 1.3 |
| Maximum | 6.9 | 6.3 | 9 | 6 |

Table 6: Shape of jaws in study participants (n=44)

| Variable (n=22) | Number | % |
|---|---|---|
| Ancient jaw(n=22) Oval | 20 | 90.9 |
| Square | 1 | 4.5 |
| V shape | 1 | 4.5 |
| Modern population jaw(n=22) | | |
| Oval | 16 | 72.7 |
| Square | 3 | 13.6 |
| V shape | 3 | 13.6 |

Table 7: Protrusion of mandible in study participants (n=16):

| Variable (n=8) | number | % |
|---|---|---|
| Protrusion of ancient mandible YesNo | 3 | 37.5 |
| | 5 | 62.5 |
| | | |
| Protrusion of modern population mandible | | |
| Yes | 1 | 12.5 |
| No | 7 | 87.5 |

## Discussion

The present study is designed to study the effects of diet (types, constituents, and processing) and the dietary habits (meals timing, cooking culture and eating habits) on the jaws and teeth, compared the changes in these factors between ancient and modern population.

In this study 44 samples were studied consist of 22 jaws of ancient and 22 patients, 18mandibles and 26 maxillae (2 child-4 adolescent and 38 adult), plus history of diet and dietary habits was taken from the modern sample.

**Diet and Dietary habits**

Table 1 in this study for vegetables showed most probably (50%) eat soft vegetables and (27.3%) eat hard vegetable daily. Table 2 for fruits showed most probably (50%) take soft fruit once a week and (40.9%) do not take fruit. Table 3 showed most of the participants (54.5%) used to eat fried, grilled and cooked food.

**Jaws Growth**

The results obtained from the mandible of the ancient, the median length is 14.1cm and of the modern population the median length of mandible is 13.cm. The result about the vertical length of maxilla the median higher in ancient 2cm than the modern 1.4cm population. The median width of ancient mandible 5.2cm and median mandible width of modern population is 4. 5cm.The

median is different from ancient to modern population about 0.7cm. The width of maxilla in ancient is 5.6cm and median of modern population is 5.3cm the difference was 0.3mm From these results above the measurements of the mandibles and the maxillae in all dimensions were more in ancient than modern population, these findings support the role muscular activity on the jaws growth as the experimental studies showed decrease in the sizes of muscles attached to the jaws in various animals has an effect on facial width and mandibularlength.[10], and the mastication is of pronounced effect on mandibular growth and development[11].

The results of the shapes of the jaws in table (6), of the 22 ancient jaws 20 were oval, I squared and 1V shaped, while the jaws of the 22 modern participant 16 were oval 3 squared and 1 V shaped, as we expect the diet of ancient is harder than the modern, these results look like the experimental study of Ciochon, Nisbett and Corruccini. Compared eight minipigs rose for eight months on nutritionally identical soft and hard diets; the four pigs raised on soft food had differed significantly in facial shape with shorter mandibular rami and narrower mid faces than pigs raised on hard food [12].

## Conclusion

- This study is based on the effects of types of diet and its development through the human from natural food to cooked to refined today as well a lot of new components are incorporated in today's diet, both literature and our study detect these effects. Also, dietary habits developed on all aspect in diet processing time and method taking plus the cleaning habits and tool, here also the study present its effects as it will be stated down.
- The vertical length 15.1% and width 13.9%of maxilla and mandible in ancient more than the modern8.4%) (7.15%) population respectively.
- 90.9% of ancient have oval jaw shape and 72.7% oval jaw shape in modern population.

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