

## Determination of Normal Anal Position Index in Syrian Neonates

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### Abstract

**Background:** The anal position index (API) has been studied in different countries and varies with race. This paper presents the first study to identify an API in Syrian neonates with the aim of early diagnosis of an anterior displaced anus (ADA) and its association with constipation in infancy.

**Materials and methods:** Between September 2021 to April 2022, this cross-sectional study was conducted on 200 neonates (113 males and 87 females) without any external malformation at Aleppo university hospital in Aleppo, Syria. The position of the anus was numerically identified by the API, which is the ratio of anus-fourchette distance in females and anus-scrotum distance in males to the distance between coccyx and fourchette/scrotum. Our method includes adhesive tape that was used longitudinally parallel to the mid-perineum. Then fourchette/scrotum, anus center, and the lower margin of the coccyx were marked on it. Distances marked on each tape were then measured with a simple ruler. The relationship between API and other parameters was analyzed.

**Results:** The API values were  $0.56 \pm 0.1$  (95% CI: 0.54–0.58) for newborn males and  $0.45 \pm 0.09$  (95% CI: 0.43–0.47) for newborn females. The difference in API between males and females was significant ( $p$ -value = 0.01)

**Conclusion:** API in Syrian neonates was similar to other ethnic populations. API is higher significantly in males. There is no correlation between API and birth weight, length, or head circumference. We recommend that API to put into practice as an objective reliable parameter in the neonatal period because it is easily measured and contributes to the early diagnosis of ADA.

**Keywords:** anal position index, anterior displaced anus, ectopic anus, neonate

### Introduction

Although anteriorly displaced anus was recognized early in 1978 by two independent studies [1,2], there is no clear standard or criteria to define this anomaly at that time. Resiner et al 1984 published the first report talking about the normal position of the anus and he described the API as a simple method to identify it [3]. Then, many reports from different hospitals worldwide were shared for the reference data of the API. The purpose of the study is to determine the normal value of API in Syrian neonates and analyze its correlations with gender, weight, length, and head circumference.

### Materials and methods

Two hundred normal infants born at Aleppo university hospital between September 2021 and April 2022 were included in the study. The old of the participated infants ranged from 1 to 30 days. Neonates born before 35 weeks of gestation were excluded from the study, whereas those born at 35–37 weeks of gestation were defined as preterm infants. All babies with congenital anomalies or syndromes were also excluded from the study. An occult abnormality that looked normal on initial assessment and needed further investigations like Hirschsprung's disease or congenital spine deformity were included in the exclusion criteria.

Measurement of definite distances to calculate API was performed while the baby was lying on his or her back with hips and knees flexed (lithotomy position). Our method includes adhesive tape that was used longitudinally through the mid-perineum. Then fourchette/scrotum, anus center, and the lower margin of the coccyx were marked on it. Required distances marked on each tape were then measured from the base of the scrotum to the anus and from the base of the scrotum to the coccyx for study-participating males Fig (1), and from the vaginal fourchette to the anus and from the vaginal fourchette to the coccyx for study-participating females (Fig 2).

The measurement was made with a simple ruler Fig (3). Then, the API was then calculated using the following formula:

$$\text{API in males: } \frac{\text{Scroto-anal distance (cm)}}{\text{Scroto-coccygeal distance (cm)}}$$

$$\text{API in Females: } \frac{\text{Fourchette-anal distance (cm)}}{\text{Fourchette-coccygeal distance (cm)}}$$

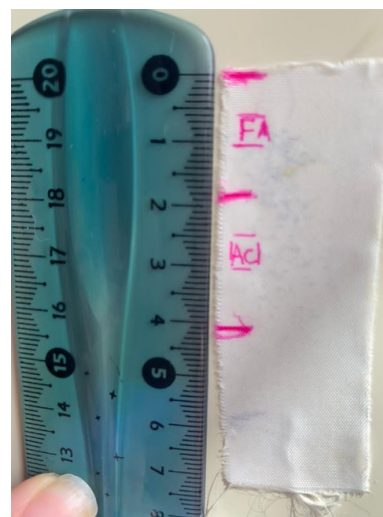
Male and female newborns were matched for variables such as body weight, height, and head circumference.



**Figure 1:** Measurement of API in male newborn.



**Figure 2:** Measurement of API in female newborn.



**Figure 3:** Measurement of the marked distances with a ruler.

## Results

A total of 200 Syrian infants, comprising 113 (56.5%) male and 87 females (43.5%) included in the present study. The majority (n=157, 78.5%) were term neonates, while the remaining (n=43, 21.5%) were premature neonates. The proportion of premature birth was similar for both genders (males, n = 25, 22.1%; females, n = 18, 20.6%).

The mean API values were  $0.56 \pm 0.1$  (95% CI: 0.54–0.58) for newborn males and  $0.45 \pm 0.09$  (95% CI: 0.43–0.47) for newborn females. The difference in API between males and females was significant (p-value = 0.01) Table [1].

The average birth weight in all babies was  $2591.36 \pm 601.83$  g (p-value = 0.706). The average birth weight in male babies was  $2641.73 \pm 631.72$  g (p-value = 0.951), while the average birth weight in female babies was  $2525.94 \pm 557.42$  g (p-value = 0.513). Therefore, there was no significant correlation between birth weight and API.

Considering the study outcome, the average length in all babies was  $46.77 \pm 3.28$  cm (p-value = 0.27). On the other hand, the average length in male babies was  $46.94 \pm 3.24$  cm (p-value = 0.33), and the average length in female babies was  $46.54 \pm 3.35$  cm (p-value = 0.96). Subsequently, there is no co-relation between the length of the babies and API.

**Table 1:** Results of API and other parameters in the present study with its correlations.

	Overall	Male	Female
<b>Weight</b>	$2591.36 \pm 601.83$ g (p-value = 0.706)	$2641.73 \pm 631.72$ g (p-value = 0.951)	$2525.94 \pm 557.42$ g (p-value = 0.513)
<b>Height</b>	$46.77 \pm 3.28$ cm (p-value = 0.27)	$46.94 \pm 3.24$ cm (p-value = 0.33)	$46.54 \pm 3.35$ cm (p-value = 0.96)
<b>Head Circumference</b>	$33.44 \pm 2.03$ cm (p-value = 0.63)	$33.42 \pm 2.08$ cm (p-value = 0.32)	$33.47 \pm 1.98$ cm (p-value = 0.62)
<b>Anal Position index (API)</b>		$0.56 \pm 0.1$ (p-value = 0.01)	$0.45 \pm 0.09$ (p-value = 0.01)

The average head circumference in all babies was  $33.44 \pm 2.03$  cm (p-value =0.63). In detail, the average head circumference was  $33.42 \pm 2.08$  cm (p-value =0.32) in male babies and  $33.47 \pm 1.98$  cm (p-value =0.62) in female babies. As a result, there is no link between the head circumference of the baby and API.

**Table 2:** API values recorded in different studies among various ethnic populations.

Study	Age group	API $\pm$ SD in male	API $\pm$ SD in female
Reisner et al. 1984 [3]	Newborn	0.58 $\pm$ 0.06	0.44 $\pm$ 0.05
	18 months	0.56 $\pm$ 0.4	0.40 $\pm$ 0.06
Bar-Maor & Eitan 1987[12]	3 days–12 years	0.56 $\pm$ 0.2	0.39 $\pm$ 0.09
	Constipated 3d-12y	0.58 $\pm$ 0.09	0.40 $\pm$ 0.07
Genc 2002 (Turkey) [17]	Newborn	0.53 $\pm$ 0.05	0.46 $\pm$ 0.08
Mohta & Goel 2004 (India) [11]	Newborn–3 years	0.43 $\pm$ 0.05	0.37 $\pm$ 0.06
Herek & Polat 2004 ( Turkey) [9]	Newborn–10 years	0.51 $\pm$ 0.08	0.36 $\pm$ 0.08
Davari 2006 (Iran) [8]	Newborn	0.54 $\pm$ 0.07	0.42 $\pm$ 0.08
Rerksuppaphol et al 2008 (Thailand) [14]	Newborn	0.51 $\pm$ 0.07	0.38 $\pm$ 0.08
Torres-Sanchez et al 2008 ( Mexico) [15]	Newborn–Infants	0.6 $\pm$ 0.07	0.5 $\pm$ 0.07
Chan et al 2009 ( Taiwan ) [4]	Neonates	0.54 $\pm$ 0.03	0.40 $\pm$ 0.04
	5–19 months	0.53 $\pm$ 0.02	0.39 $\pm$ 0.06
Shahin & Abdelsalam 2011 (Egypt) [18]	Newborn	0.51 $\pm$ 0.07	0.38 $\pm$ 0.08
Núñez-Ramos et al. 2011 (Spain) [19]	Newborn	0.53 $\pm$ 0.06	0.40 $\pm$ 0.05
	Older constipated patients	0.47 $\pm$ 0.10	0.36 $\pm$ 0.10
Núñez-Ramos et al. 2011 (Italy) [5]	Newborn	0.51 $\pm$ 0.06	0.39 $\pm$ 0.08
Suryana & Makhmudi 2018 (Indonesia) [10]	Newborn	0.46 $\pm$ 0.06	0.37 $\pm$ 0.07
Patel et al 2018 ( India ) [16]	Newborn and infants	0.53 $\pm$ 0.07	0.36 $\pm$ 0.07
Tufekci & Yesildag 2021 (Turkey) [20]	Newborn	0.52 $\pm$ 0.05	0.39 $\pm$ 0.04
Present study 2022 (Syria)	Newborn	0.56 $\pm$ 0.1	0.45 $\pm$ 0.09

## Discussion

Anterior anus, anteriorly displaced anus (ADA), anterior ectopic anus, anteriorly located anus, or short perineal body are synonyms for the same anomaly [4]. Anterior displacement of the anus is an anatomical variation of the normal position of the anus in the perineum whose diagnosis usually goes undetected in neonates.[5] The diagnosis of the anterior ectopic anus is traditionally made on physical examination; however, this results in large variation between physicians [6]. From the embryonic point, ADA is usually associated with malformation of the mid-portion of the external sphincter and weakness of the corresponding segment of the anal canal [7]. However, it is reported that anteriorly located anus is seen almost exclusively in girls [1,2,3]

As mentioned above, API was created to identify the normal position of the anus and to detect ADA in early life. Following Resiner in 1984, many papers started to talk about API using various methods for measurements like measurement tape, digital scale, or a ruler as in our study. Therefore, one should adopt a single uniform method for measurement and correlate it with clinical symptoms [13]

Moreover, the relation between the API and other parameters was investigated. These parameters include age, gender, gestational age, birth weight, length, and prematurity.

In our study, the mean API in male neonates is  $0.56 \pm 0.1$  (95% CI: 0.54–0.58), while in female neonates is  $0.45 \pm 0.09$  (95% CI: 0.43–0.47). The API was noted to be higher in males and the difference between gender was found to be statistically significant ( $p$ -value = 0.01). Based on an analysis of 18 papers talking about the location of the anus, Sharma et al, 2021 concluded the variations of API in various ethnic populations were insignificant Table [2][13]. In addition, the API is significantly ( $p$ -value < 0.05) higher in males [13]. In our report, the API was also higher in male babies ( $p$ -value = 0.01).

Based on the above, we concluded no link between the birth weight, length, or head circumference and API.

Regarding gestational age, two studies found no relation between API and gestational age [6,10], while only one paper concluded a significant correlation between API and gestational age as higher gestational age causes lower API [6].

Concerning age, two reports searched for the correlation between age and API and concluded no correlation [4,12]. Regarding the link between the API and birth weight, two reports plus our study found no relation between birth weight and API. [10,11]. In connection with the length or height, one report plus our study deduced no correlation between the length and API [11]. Similarly, for head circumference, there is one paper plus our study that derived no linkage between the head circumference and API.[11]

The association between ADA and constipation was observed in many reports [1,2,3], while others deemed this relation was overestimated [5]. Herek discovered that the incidence of constipation in children with a normal anal index and those with a low anal index indicative of an ADA was not significantly different [9].

It is recommended that the baby with abnormal API should have an early referral to a pediatric surgeon for further assessment and possible intervention in the future if symptoms like chronic constipation occur. Therefore, the abnormal API alone should never be considered as an absolute indication for surgery and the only indication of surgery in these patients was abnormal muscle complex as a main cause of chronic constipation, therefore regardless of its nature (a normal variant of anus location or perineal fistula), its symptom should be considered for its management. (4,5,8,13)

## Conclusion

API in Syrian neonates was similar to other ethnic populations. API is higher significantly in males. There is no correlation between API and birth weight, length, or head circumference. We recommend that API to put into practice as an objective reliable parameter in the neonatal period because it is easily measured and contributes to the early diagnosis of ADA.

## Conflict of Interest

The authors declare no conflict of interest.

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