

# Anthropometric Measurements of Term Neonates at the Maternity Ward of the Dschang District Hospital and their Weight Change during the First Two Weeks of Life

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## Abstract

**Background:** Reference standards of anthropometric measures may vary with environment. Those used in Cameroon are specific to other contexts.

**Objective:** Describe the anthropometric measures of full-term new-borns of gestational age (GA) of 37 to 42 weeks as well as the change in weight during the first two weeks of life and compare them with new-borns' reference curves available.

**Methods:** Descriptive study with prospective hospital measurement of anthropometric parameter of full-term new-borns. We included new-borns without any malformation nor mother's conditions like hypertension, diabetes, sickle cell anaemia, HIV or pre-eclampsia/eclampsia that could impair fetal growth. The study focussed on the assessment of changing in weight during the first two week of life. The weight, head, mid-upper arm and chest circumference as well as the length were recorded at birth, and subsequently, the weight on days 7 and 14.

**Results:** In all of the 388 new-borns enrolled, 179 (53%) were girls. Their mean weight was  $3281.74 \pm 419.98$  grams, their mean head and upper arm circumference were  $34.20 \pm 1.51$  cm and  $10.93 \pm 0.84$  cm respectively. Their mean length was  $49.60 \pm 2.3$  cm. Weight loss occurred in all new-borns as early as the first 24 hours of life and half of them (52.02%) had regained their birth weight on day 7, and 98% on day 14, with a mean weight gain of 23.19 g per day. The weight curves

according to their GA were above the Fenton reference, suggesting an overestimation of the birth weight of the studied population.

**Conclusions:** Because of the scarcity of growth charts, local studies of the same nature would help establish standards specific to our populations; the present work is a step in this process.

**Keywords:** Anthropometric Measures; Weight Change; Full-Term New-Born.

## Introduction

Anthropometric measures are used to describe an individual's growth within a given population [1]. They not only reflect nutritional and health status, but can also be used to predict the child ability and survival [2]. These measures depend on genetic, racial, nutritional and geographical factors. According to Gardosi, the factors that affect fetal growth are the weight, length, ethnic origin of the mother, and sex of the foetus. Each parent hands down to the foetus a gene pool endowing it with an individual growth potential [3]. It is well known that in each country, standard neonatal anthropometric measures vary at different gestational ages [3, 4]. The need to design population-specific fetal growth curves and birth weight data which are updated locally has been highlighted by many countries [5]. Establishing a curve that is validated by a state calls for the conduct of several studies on anthropometric measures. Various African countries have started this procedure, including Nigeria, Senegal, Egypt, Zambia and Benin. In April 2006, the World Health Organisation (WHO) published new standards to assess child growth and development from birth to the age of five [6]. Although the WHO recommends a single international growth standard for developing countries, the best scenario is to have Cameroon own, national growth curves established and designed according to the features described by the WHO [7, 8]. In Africa, we continue to use curves established according to the European standard because, ours are not yet available. This study sought to analyse the birth weight, the head, mid-upper arm and chest circumference, as well as the length of full-term new-borns at a maternity ward, and to track their weight change during the first two weeks of life.

## Tools and Methods

This descriptive study using prospective data collection in a hospital setting for birth that occurred from 29 January 2020 to 29 April 2020 at the maternity ward of the Dschang District Hospital. The aim of a prospective study was to improve data's collection, since our medical files are not always well filled. Dschang is the second big town in west region of Cameroon. Its particularity is to have a University, meaning that the population includes many students. The hospital is about 300 meters from the University. The maternity ward of the Dschang District Hospital has a medical staff and a nursing staff composed with 01 gynaecologist, 01 general practitioners, 04 midwives and 16 nurses. There is 01 paediatricians in this hospital. The study concerned 338 term neonates born alive with gestational age between 37 and 42 weeks from the last menstrual period (LMP), in this facility. The study excluded those whose mothers suffered from hypertension, diabetes, sickle cell disease, HIV, pre-eclampsia or eclampsia, and those with malformations that could impair growth and development. This present work consisted in measuring the birth weight, head, mid-upper arm and chest circumference, as well as the length of the full-term new-borns, and in tracking their weight change during the first two weeks of life. Data was collected within one hour of birth. Weight was recorded on day 1, day 7 and day 14 of their lives.

We used the 'BYB01' electronic baby scale with a built-in non-graduated recumbent measuring board, and a tape measure graduated in centimetres. Birth weight, measured in grams (g), was obtained by weighing the naked new-born on a pre-tared electronic scale. Head circumference, measured in centimetres (cm), was obtained by passing a 150-cm-long non-stretchable tape measure graduated in millimetres above the eyebrows and ears round the frontal prominence and the occipital prominence. The chest circumference (cm) was measured at the level of the nipple tip using the same tape measure. The mid-upper arm circumference was measured on the left arm, in between the top of the shoulder and the elbow. The length (cm) was measured using a non-graduated measuring board with the new-born lying on its back. The graduated non extensible tape measure was used to measure the crown-heel length. Weigh for gestational age, was projected on the Fenton growth chart.

## Ethical Considerations

This work received clearance from the "This work received clearance from the "University of the Mountains" Institutional Ethic Committee. Prior and informed verbal consent was obtained from the mothers following an explanation of the purpose of the study.

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### Statistical Analyses

Qualitative data was expressed as percentages and quantitative data as mean ± standard deviation for normal distribution. After calculating the mean weight of the new-born from 37 to 42 weeks LMP, we plotted the different weights at different percentage (P), thus P3, P10, P50, P90 and P97. Thus, at P3, we obtained a GA of 37 weeks LMP for girls and boys; at P10, it was a GA of 37 weeks + 6 days LMP for girls and 37 weeks + 4 days LMP for boys; at P50, we had a GA of 39 weeks + 5 days LMP for girls and 39 weeks + 4 days LMP for boys; at P90, the GA was 41 weeks + 1 day LMP for girls and boys; and at P97, GA was 41 weeks + 4 days LMP for girls and 41 weeks + 5 days LMP for boys. Then, we used the <https://apps.cpeg-gcep.net/prem2013> DDE app to project the weights according to gestational age on the Fenton growth chart.

### Results

The study included 338 new-borns of whom 179 (53%) were girls and 159 (47%) boys. We lost sight of 115, and 223 came back within the two weeks of birth.

Table 1 shows that the weight of male new-borns exceeded that of female new-borns.

Anthropometric Measurements	Sex	Mean ± Standard Deviation
Weight (g)	♀	3221 ± 410
	♂	3350 ± 422
	♀♂	3281.74 ± 419.98
Length (cm)	♀	49.4 ± 1.9
	♂	49.9 ± 2.1
	♀♂	49.60 ± 2.3
Head circumference (cm)	♀	34.1 ± 1.5
	♂	34.3 ± 1.5
	♀♂	34.20 ± 1.51
Chest circumference (cm)	♀	33.0 ± 1.8
	♂	33.2 ± 1.8
	♀♂	33.08 ± 1.80
Mid-upper arm circumference (cm)	♀	10.9 ± 0.9
	♂	11.0 ± 0.8
	♀♂	10.93 ± 0.84

♀= female; ♂= male; ♀♂= female and male

**Table 1:** Anthropometric Measurements of New-borns by Sex

The mean weight was  $3281.74 \pm 419.98$  grams; it was  $3350 \pm 422$  grams for boys and  $3221 \pm 410$  grams for girls. The mean head circumference was  $34.20 \pm 1.51$  cm, with  $34.3 \pm 1.5$  cm for boys and  $34.1 \pm 1.5$  cm for girls. The mean chest circumference was  $33.08 \pm 1.80$  cm, with  $33.2 \pm 1.8$  cm for boys and  $33.0 \pm 1.8$  cm for girls. The mean mid-upper arm circumference was  $10.93 \pm 0.84$  cm, i.e.  $11.0 \pm 0.8$  and  $10.9 \pm 0.9$  cm for boys and girls respectively. The mean length was  $49.60 \pm 2.3$  cm, i.e.  $49.9 \pm 2.1$  cm for boys and  $49.4 \pm 1.9$  cm for girls.

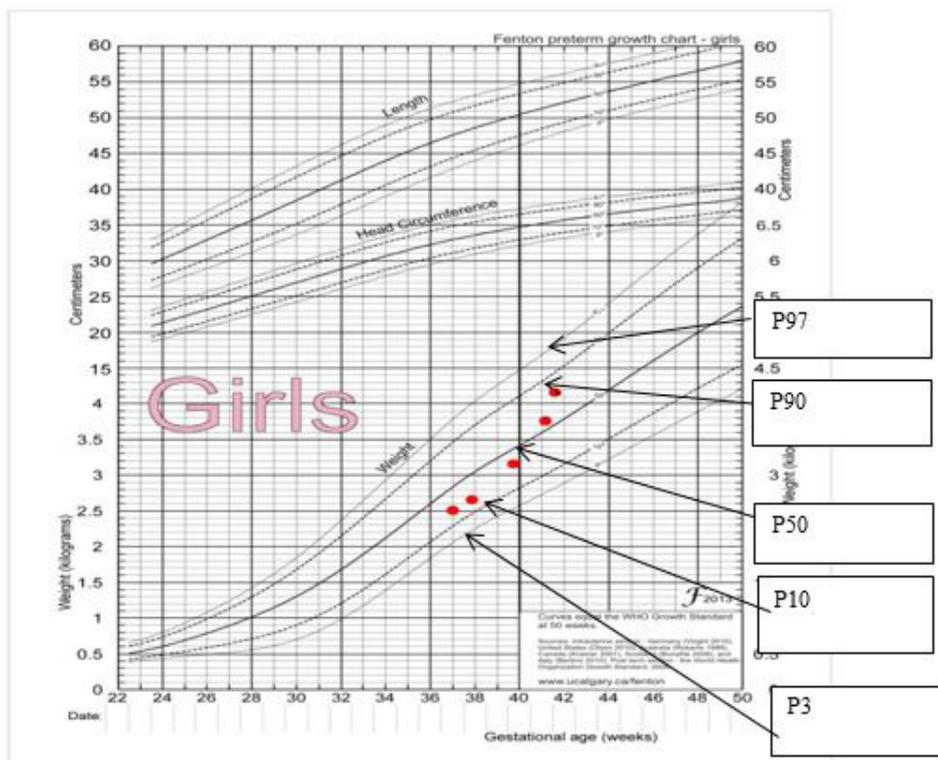
As shown in Table 2, 2.96% of new-borns were hypotrophic at birth, i.e. 1.89% of boys and 3.91% of girls. The majority (94.08%) were eutrophic and only 2.96% were macrosomic (3.14% of boys and 2.79% of girls).

Sex	Trophicity			Total
	Hypotrophic (BW <2508 g)	Eutrophic (BW=2508-4145 g)	Hypertrophic (BW >4145 g)	
♀	07 (3.91%)	167 (93.30%)	05 (2.79%)	179
♂	03 (1.89%)	151 (94.96%)	05 (3.14%)	159
♀♂	10 (2.96%)	318 (94.08%)	10 (2.96%)	338

BW = birth weight ♀= female; ♂= male; ♀♂= female and male

**Table 2:** distribution of new-borns according to trophicity

Figures 1 and 2 show the weights of girls and boys for gestational age, projected on the Fenton growth chart. It can be seen that for any percentile (P) corresponding to a specific gestational age, the weight of newborns was higher than that of the Fenton curve.



Where P= percentile

**Figure 1:** Girls Weight by Gestational Age, projected on the Fenton growth chart

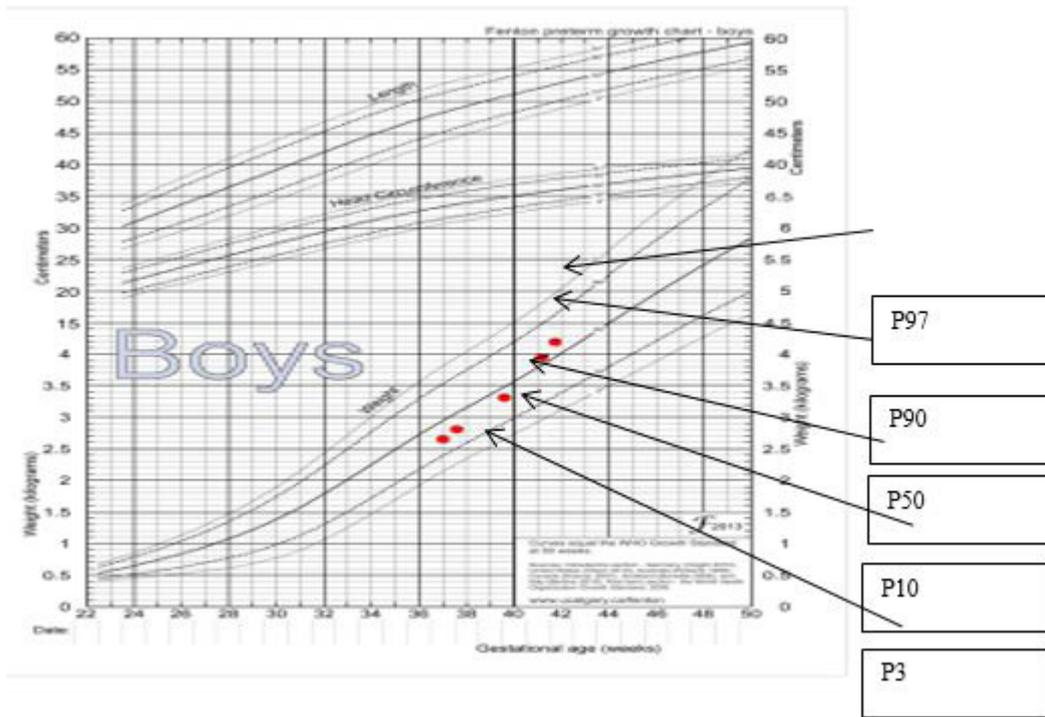


Figure 2: Boys Weight by gestational age, projected on the Fenton growth chart

Regarding weight change during the two weeks following birth, figure 3 shows a decrease between birth and day one, followed by a sharp increase throughout the follow-up period. However, it decreased more slowly and increased more rapidly for boys than for girls. Be it during the falling or the rising phase, the boys' weight curve remained concurrently below that of girls.

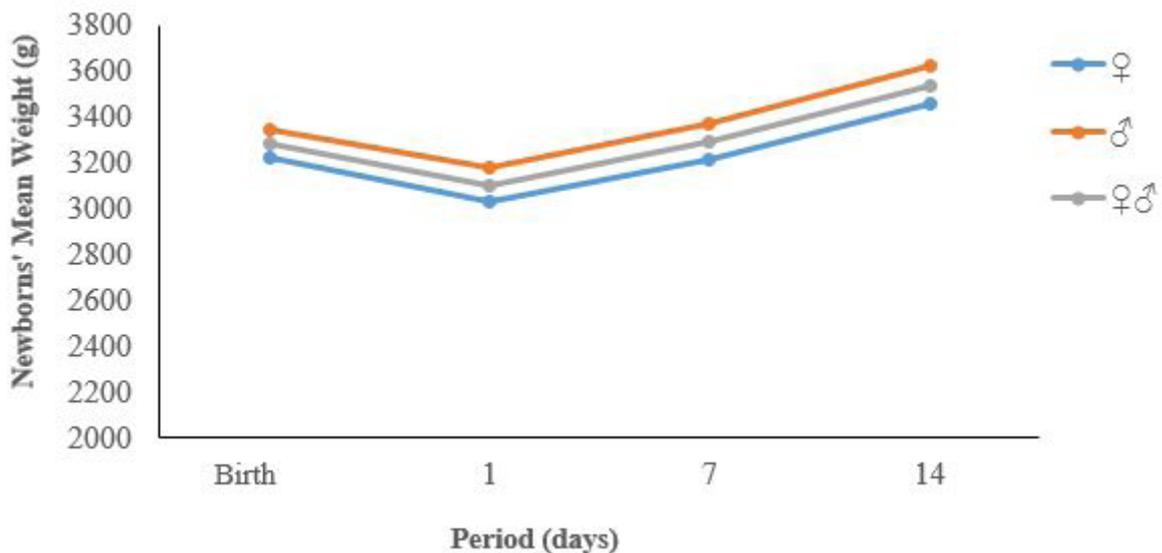
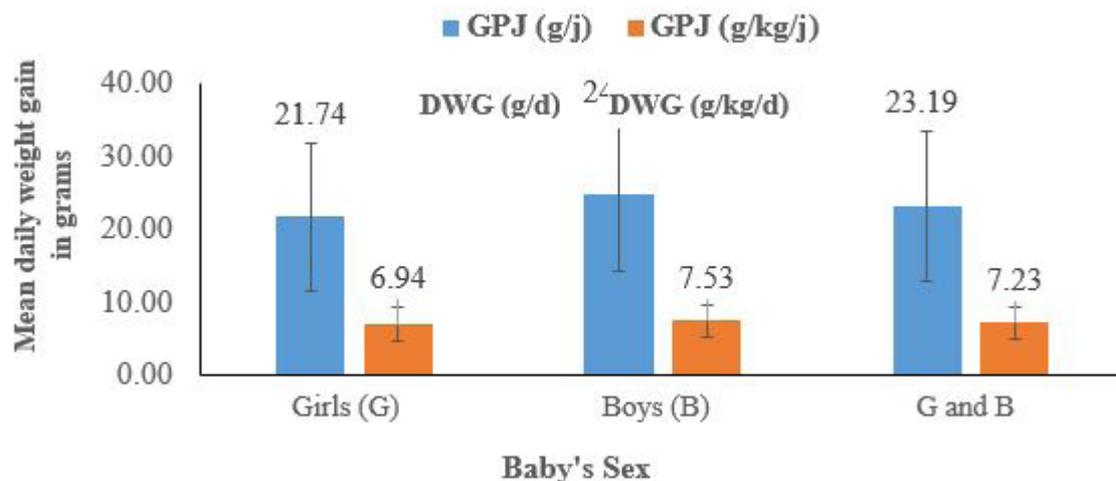


Figure 3: Weight Change in New-borns from Birth to the second week of their Lives

The new-borns gained an average of 23.19 g/day during 2 weeks of life (figure 4)



**Figure 4:** weight gain in new-borns during the two weeks postpartum

The distribution of new-borns according to the percentage of weight change (Table 3) shows that on day one of life, all new-borns had lost weight. After 7 days, 52.02% had regained their birth weight, i.e. 59.05% of boys and 45.76% of girls. On day 14, 47.98% had regained weight, i.e. 40.95% of boys and 54.23% of girls.

Sex	Headcount	Postnatal period		
		Day 1	Day 7	Day 14
♀	n=118	0 (0%)	54 (45.76%)	64 (54.23%)
♂	n=105	0 (0%)	62 (59.05%)	43 (40.95%)
♀♂	n=223	0 (0%)	116 (52.02%)	107 (47.98%)

♀ = female; ♂ = male; ♀♂ = female and male

**Table 3** distribution of new-borns according to percentage of weight regained

Anthropometric parameters	Age (days)	Sex of new-born		p
		♀ (n=118)	♂ (n=105)	
Weight(g)	Birth	3219,84±426,5 <sup>b</sup>	3332,82±436,4 <sup>a</sup>	0,046
	14 days	3463,72±473,5 <sup>b</sup>	3628,83±501,3 <sup>a</sup>	0,010
Length (cm)	Birth	49,39±1,9 <sup>b</sup>	49,70±2,1 <sup>a</sup>	0,239
	14 days	49,80±1,8	50,10±2,3	0,272
Head circumference (cm)	Birth	33,91±1,4	34,18±1,5	0,176
	14 days	34,85±1,6 <sup>b</sup>	35,50±1,6 <sup>a</sup>	0,003
Thoracic circumference (cm)	Birth	33,05±1,8	33,16±1,8	0,644
	14 days	35,73±2,1	36,10±2,2	0,193
Brachial circumference (cm)	Birth	10,90±0,8	10,84±0,86	0,614
	14 days	11,61±1,02	11,70±1,04	0,501
Ponderal index (g/cm <sup>3</sup> )	Birth	0,027±0,003	0,027±0,003	0,264
	14 days	0,028±0,003	0,029±0,005	0,065

<sup>a, b</sup> : No significant difference with the same letter (p > 0,05). n = sample size. p = probability. ♀ = Girls(G), ♂ = Boys(B), ♀♂ = G and B

**Table 4 :** Influence of sex of new-borns

## Discussion

The present study describes the anthropometric measurement of full-term new-borns and their weight change during the first two weeks of life. The limitation of this study is that the results obtained depict the situation of a single hospital and a small size of the population. Ideally, the study should be extended to other regions in order to establish national curves as required by the WHO. It should also be noted that this study took place amidst the COVID-19 pandemic, which could explain the number of people we lost sight of, probably due to the lockdown.

Data on birth weight indicates the key role the geographical context plays on fetal growth [9]. For this reason, the best way to assess the growth status of children within a population is to establish customised regional curves. Establishing such local national curves would include country-specific characteristics as recommended by the WHO [10]. The first standard regarding growth indexes is that the selected population is made of children considered normal, ie with a good nutritional status and grow up in optimum conditions [7]. The mean birth weight of the new-borns in this study was 3281 g + 419.98. It was near than those of Tietche et al. in Cameroon [13], Ndiaye et al in Senegal [14], Oluwafemi and al in Nigeria [15] and BHAT et al in Zambia [16]. However, it is significantly lower than those found by Telatar et al. in Turkey [17] and Awadh et al. [18] in Egypt which varied from 3334 g to 3463.3 g. As the case in several studies [11, 12], who showed that male new-borns were bigger than girls. Concerning the head circumference, the mean in our study was 34.20 cm, which is lower than those of Tietche et al [13], Ndiaye et al [14], Bhat et al [16] and Awadh et al [18] who obtained 34.47 cm, 34.60 cm, 34.55 cm and 35.13 cm, respectively. Elsewhere, the birth length, was 49.60 cm; lower than those of Niazi et al [3] in Saudi Arabia et al and Taksande et al [8] in India, who obtained 51.1 cm and 51.15 cm respectively.

Given that there were no local curves, we compared the results of this study by projecting them individually on the Fenton curve at P3, P10, P50, P90 and P97. We discovered that for both girls and boys, for a given percentile and at the same gestational age, the weight of new-borns in this study was higher than that on the Fenton curve.

Weight loss was observed after the first few days of life. Indeed, it is physiologically normal for a child to lose weight at birth. The new-born loses water via urine, meconium, and must fight against heat loss [19]. On another hand, this could be as a result of delay breastfeeding which is frequent in our context especially for primiparous women [20]. It may also be due to the imbalance created when the foetus stops feeding through the placenta. Weight was regained well before day 7. Whereas, in the existing literature, weight is usually regained between day 10 and day 14.

Thus, 52.02% had regained their weight on day 7, and 47.98% on day 14. In addition, these new-borns had gained 23.19 g/day. This is in line with what is stated in existing literature that between 0 and 1 month, the new-born gains 20 to 30 g/day.

The rate of hypotrophic new-borns in the present study was 2.96%. This figure is higher than the results found by Sepou et al. [21] in Bangui (2.9%) and by Bijlu [22] in Douala, Cameroon (2.10%). This could be because at term, the placenta calcifies and no longer permits the smooth passage of nutrients necessary for fetal growth. The slight preponderance of hypotrophy in female new-borns in this study probably illustrates the tendency that boys' birth weight is higher than girls' [23, 24, 25]. Gestational disorders may possibly have more profound effects on intrauterine growth in girls than in boys. We think that, in our study, anthropometric parameters of the mother, her nutrition during the pregnancy and her age may have an impact on the growth of the babies. Further studies in better conditions are needed to answers others questions.

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## **Author's contribution**

Conception of the work: Atyam, Nguetack, Fondop, Koki

Collecting of Data: Momo, Ondo

Reduction of Article: Momo, Atyam, Ondo, Akamba

Critical Relecture of article: Nguetack, Fondop, Koki

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