

The role of skin fold thickness in the assessment of maturity in newborn infants

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Abstract

Gestational age has traditionally been used as strong indicator for the risk of neonatal morbidity and mortality. Indeed, survival increases with increasing gestational age. Therefore a full-term neonate carries less morbidity and mortality in comparison with preterm neonate. Assessment of maturity requires the utilization of many physical and neurological criteria. Measurement of skin fold thickness is an easy maneuver. The aim of the present study is to assess whether the skin fold thickness is of benefit in the assessment of maturity. One hundred preterm and 100 full-term neonates, their skin fold thickness were measured by using the skin fold thickness caliper, the skin fold thickness of the preterm neonates ($2.4 \text{ mm} \pm 0.5$) were found to be significantly lower than the skin fold thickness of the full-term neonates ($4.2 \text{ mm} \pm 0.9$) at a P value of less than 0.01. It is evident from this study that there was a strong positive correlation between the gestational age and the skin fold thickness, that is mean the skin fold thickness is higher with increasing gestational age. In conclusion; skin fold thickness can be considered as a parameter in the assessment of maturity of the newborn neonates.

دور سُمك طية الجلد في تقييم النضوج لدى الأطفال حديثي الولادة

حسنة عبيد الجنابي

المستخلص

ان عمر الجنين داخل الرحم كان قديماً يستخدم كمؤشر كبير لتحديد نسبة الوفيات لحديثي الولادة . لذلك تزداد نسبة الأطفال حديثي الولادة الأحياء كلما تزداد مدة بقاؤهم داخل الرحم قبل الولادة ، ولذلك ان حديث الولادة الكامل النمو داخل الرحم اقل عرضة للاصابة بالامراض او الوفاة بالمقارنة مع حديث الولادة الخديج . لقد كان تقييم النضوج لحديثي الولادة يستوجب استخدام معايير فيزيولوجية وعصبية . ان قياس سُمك طية الجلد هي عملية بسيطة . ان هدف هذا الدراسة يكمن في تقييم امكانية استخدام قياس سُمك طية الجلد لتحديد النضوج لدى حديثي الولادة . لقد تم أخذ (100) طفل حديث الولادة خديج وكذلك (100) طفل حديث الولادة ناضج ، وقد تم قياس سُمك طية الجلد لكل واحد من هؤلاء الاطفال وذلك باستخدام جهاز قياس سُمك طية الجلد. لقد بلغ معدل سُمك طية الجلد لدى حديثي الولادة الخديج هو $2,6 \text{ ملم} \pm 0,5$ والذي هو اقل بصورة ملحوظة عن معدل سُمك طية الجلد لدى الاطفال حديثي الولادة الناضجين والبالغ $4,2 \text{ ملم} \pm 0,9$. لقد تبين من هذه الدراسة ان هناك علاقة ايجابية وقوية بين عمر الجنين داخل الرحم وسُمك طية الجلد ، وبمعنى اخر ان سُمك طية الجلد المقاس لدى الحديث الولادة يزداد كلما كان هذا الوليد قد مكث مدة اطول داخل الرحم قبل ولادته.

Introduction

Live born infants delivered before 37 completed weeks from the 1st day of the last menstrual period are termed preterm by the World Health Organization (WHO). While the full-term neonate is the neonate who is delivered with a gestational age that ranges between 37 completed weeks to 42 weeks. ⁽¹⁾ The most practical methods of determining body fat are through the use of calipers to measure the skin fold thickness, which is affected by underlying adipose or fat tissue. By pinching the skin and pulling it away from underlying muscle tissue, one is able to measure the amount of fat that attaches to the skin. Since approximately 50% of the fat in the human body lies underneath the skin, it is then possible to predict overall body fat. A Skin fold Caliper is a device which measures the thickness of a fold of skin with its underlying layer of fat. ^(2, 3) There are instruments that measure the thickness of a subcutaneous (under skin) fat layer at different locations on the body. These measurements are then used in a scientifically proven mathematical formula to calculate the total body fat. The calipers measure in mm of skin fold thickness. ⁽⁴⁾ The most popular site for the measurement of the skin fold thickness is the triceps (located on the back of the upper arm). Other sites include the biceps (front of the upper arm), subscapula (just below the tip of the right scapula), iliac crest (vertical fold above the hip bone), abdomen (one inch to the right of the belly button), thigh, and chest. ⁽⁵⁾ Proper technique of skin fold thickness measurements requires training. Even under the best of circumstances, individual differences in measurement techniques are common. ⁽⁶⁾

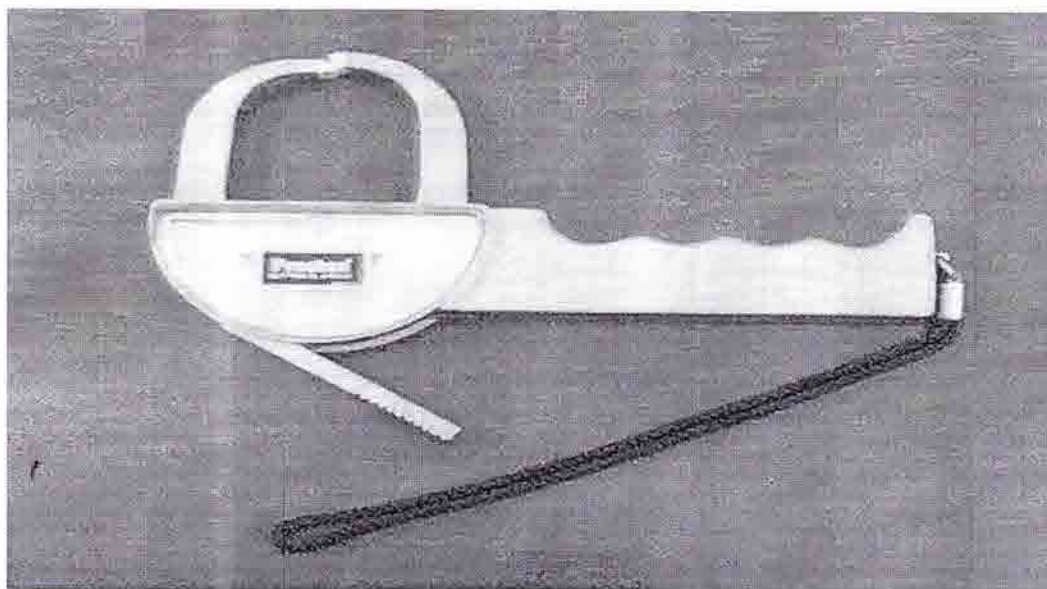
The aim of this study is to use the skin fold thickness as a criterion for the assessment of the maturity of the newborn neonates.

Patients and Methods

This descriptive-analytic cross sectional study was accomplished in delivery room in Tikrit Teaching Hospital that related to Salah-Din Government. Hundred preterm neonates (46 males and 54 females) were aged between 10 to 25 minutes, and 100 full term neonates (51 males and 49 females) of a comparable age group were included in this study. This study was conducted during the period from April 2005 till August 2006. The gestational age of each neonate was considered according to the clinical assessment of each neonate included in this study and ultrasound examination of their mothers during their pregnancy. The skin fold thickness of each neonate included in this study was measured by using skin fold caliper. The site of measurement was the triceps, in which the arm was hanged free and on the back of the upper arm, precisely between the shoulder blade and the elbow the points of the circle pin were applied. The skin area was lifted up and held steady, and the points of the circle pin were applied right by the fingers so that only the pressure from the circle pin points were pressing against the skin area on the measuring spot. The circle pin has a spring mechanism, and the handle was released to apply the incorporated pressure. Each measurement was taken three times and then the average of the three measurements was recorded. The measurements were done with the help of another person. The skin fold thickness caliper which was used in this

study was related to the Department of Physiology, Preston (Clifton, New Jersey 07012) made in U.S.A. Newborns with any of the following conditions were excluded from this study, and these conditions includes; infant of diabetic

mother, infant of thyrotoxic or hypothyroid mother, infant of hypertensive mother, syndromes, those who received oral feeding, and those with suspicion of any of the inherited metabolic disease.



A skin-fold caliper includes a base member having a handle portion and a jaw portion, a slide member having a mounting portion and a jaw portion, and a coiled spring attached between the base member and the slide member to bias the ends of the respective jaw portions together. The slide member is mounted within a recess defined by the base member for linear movement there along. The spring is selected so that a change in its extended length does not effect a large change in the force applied to close the jaws. Herein, a thin wire spring with many coils housed between the base member and slide member is utilized to obtain this function.

Results

Table (1) illustrates the physical characteristics of the newborn babies that included in this study, and these characteristics include; the number of each group, the sex distribution, the birth weight, and the age of each neonate included in this study. It is evident from this study that preterm neonates are low birth weight neonates, while the full-term neonates are of normal birth weight. It is also evident from this table that both groups of a comparable

age. *Table (2)* shows the range of gestational age, the mean \pm SD of gestational age, the range of skin fold thickness, the mean \pm SD of skin fold thickness of each studied group and of the total. It is evident from this table that the preterm neonates is significantly differ (P value of less than 0.05) from the full-term neonates regarding the gestational age. The skin fold thickness in preterm neonates is significantly lower (P value $<$ 0.01) than that in full-

term neonates. **Figure (1)** clarifies the correlation between the skin fold thickness and the gestational age in preterm neonates. It is evident from this figure that the correlation is strongly positive ($r = +0.41$, significant at the 0.01 level). **Figure (2)** shows a strong positive correlation ($r = +0.33$, significant at the 0.01 level) between the

skin fold thickness and the gestational age in full-term neonates. **Figure (3)** illustrates the correlation between the skin fold thickness and the gestational age in the total number of the studied neonates, which is a strong positive correlation ($r = +0.62$, significant at the 0.01 level).

Table (1): Physical Characteristic of the Newborns.

Groups	♂	♀	Birth weight (g) Range	Birth weight mean \pm SD	Age (min) range	Age (min) mean \pm SD
Preterm neonate	46	54	912 - 2405	1866.4 \pm 210.8	10 - 25	22.2 \pm 5.1
Full-term Neonate	51	49	2573 - 4029	3215.8 \pm 391.6	10 - 25	21.6 \pm 5.0
Total	97	103	912 - 4029	2711.5 \pm 253.1	10 - 25	21.9 \pm 5.0

♂ = male

♀ = female

Table (2): The Measurements of Birth Weight and Skin Fold Thickness of Newborns.

Groups	No	Gestational age (wk) range	Gestational age (wk) mean \pm SD	Skin fold thickness (mm) range	Skin fold thickness mean \pm SD
Preterm neonate	100	29 - 35	33.7 \pm 6.0*	2 - 3	2.6 \pm 0.5**
Full-term neonate	100	38 - 40	39.1 \pm 6.2*	3.5 - 4.5	4.2 \pm 0.9**
Total neonate	200	29 - 40	36.3 \pm 5.9	2 - 4.5	3.3 \pm 0.7

* Significant difference at a P value of < 0.05

** Significant difference at a P value of < 0.01

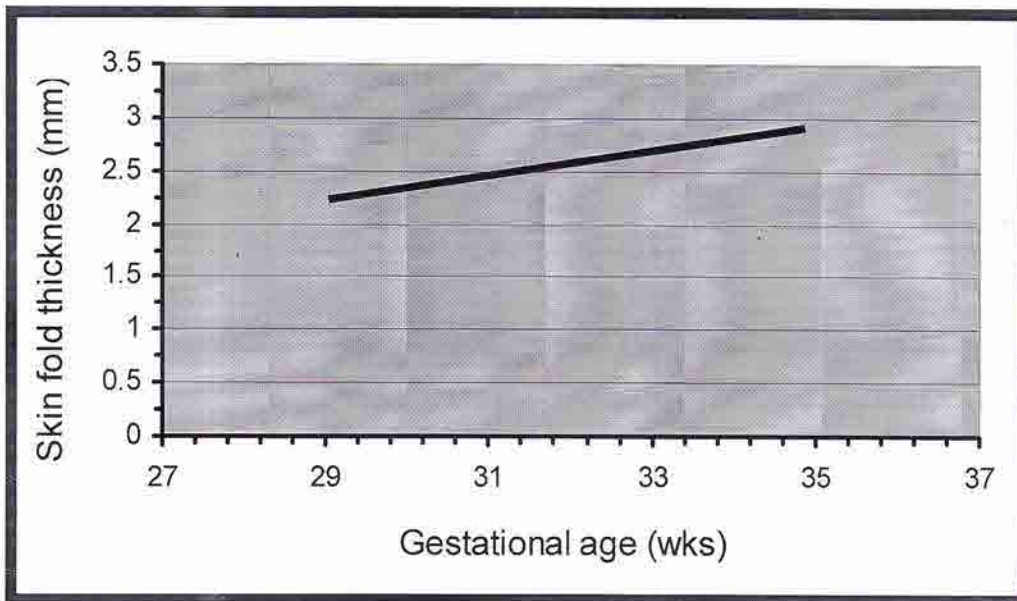


Figure (1): The correlation of skin fold thickness to gestational age in preterm neonates.

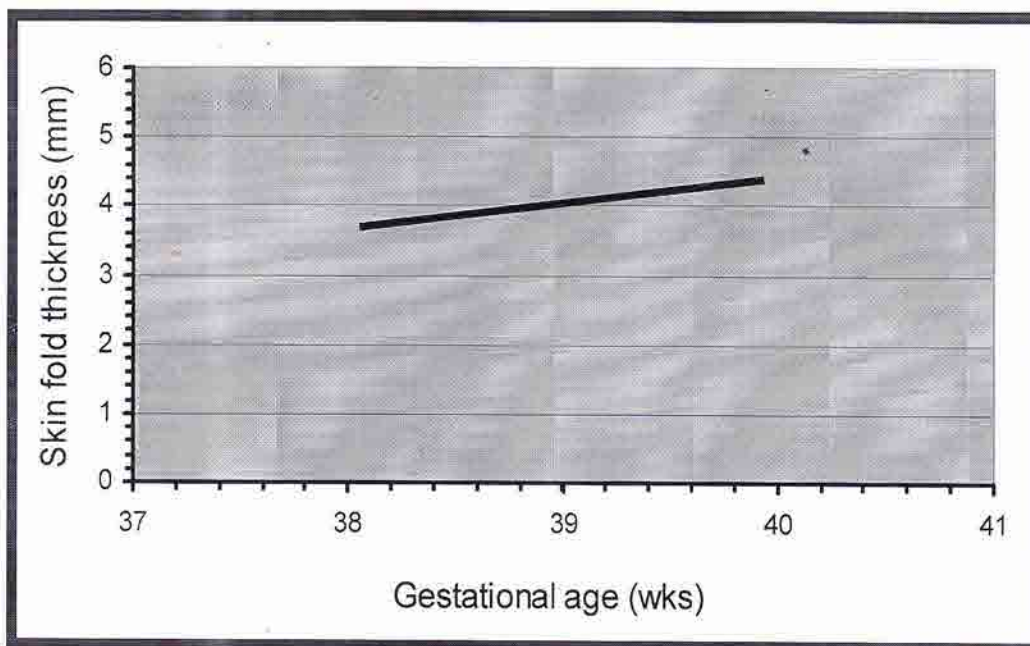


Figure (2): The correlation of skin fold thickness to gestational age in full-term neonates.

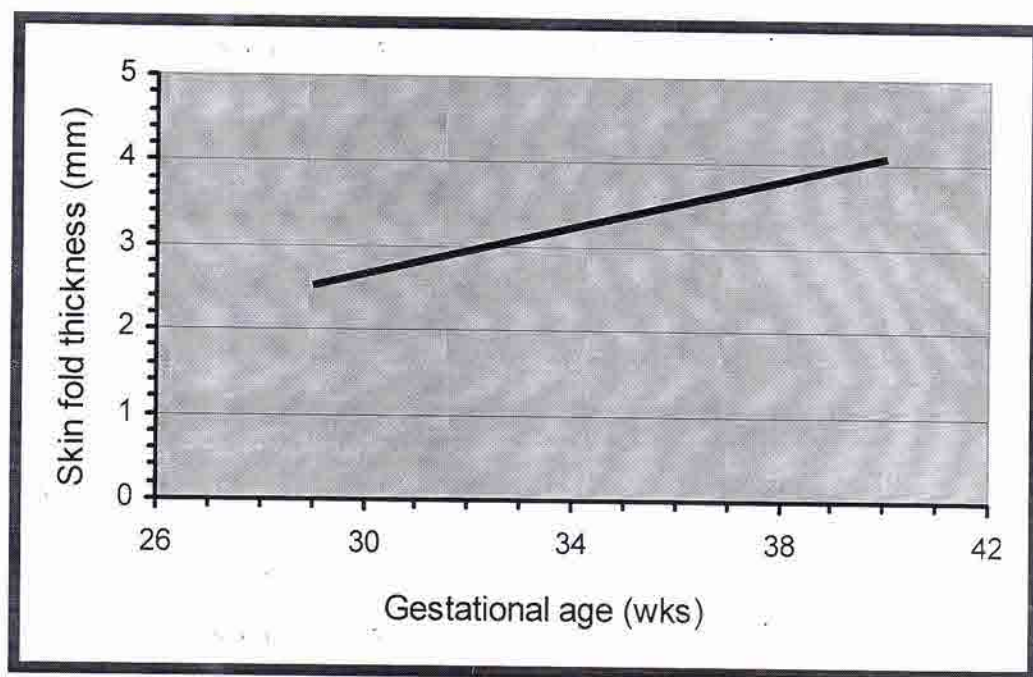


Figure (3): The correlation of skin fold thickness to gestational age in total neonate.

Discussion

Assessment of skin-fold thickness is an easy, low-cost, and noninvasive test for distinguishing preterm neonates from the full-term neonates due to their difference in their subcutaneous fat.⁽⁷⁾ Assessment of skin-fold thickness should be used as an adjunct to current physical and neurological criteria. Skin-fold thickness is a marker of the amount of subcutaneous fat.⁽⁸⁾ It is evident from this study that the more mature the neonate the thicker the skin fold, because there is a significant difference

in fold thickness between the preterm and the full-term neonates. This finding could be attributed to that; the full-term neonates spend more time in the intrauterine life therefore had a more chance to add fat to their subcutaneous tissue.⁽⁹⁾ Since approximately 50% of the body fat is present in the subcutaneous tissue layers, a correlation exists between the triceps skin fold thickness and the body's fat content.⁽¹⁰⁾ Therefore the triceps skin fold measurement may be used in the diagnosis of maturity.⁽¹¹⁾

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