Fetal Development

HASPI Medical Anatomy & Physiology 16c

Activity

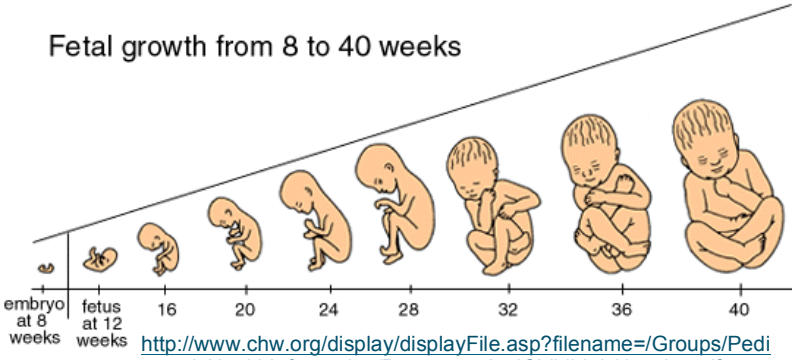
Name(s): _____

Period: _____ Date: _____

Background

Fetal Development

Monitoring the development of a fetus through pregnancy is important in determining whether there may be any abnormal conditions or health concerns for both the fetus and mother. Size and weight of the fetus being in a normal range throughout pregnancy is an important indicator of normal fetal development. Measurements of fetal size are often taken from ultrasounds and these measurements are also used to calculate fetal weight.



http://www.chw.org/display/displayFile.asp?filename=/Groups/PediatricHealthInformation/PregnancyAndChildbirth/develop.gif

Even though average fetal weights are used to determine normal or abnormal fetal growth, it is important to recognize there is a large amount of variation in fetal weight. The healthy range for birth weight is considered to be somewhere between 3000-4000 g. Only when the weight is 500 g less or more than the average is there a concern. Low birth weight and high birth weight have both been associated with an increased risk of complications at birth for both the fetus and the mother. High birth weight is anything above 4500 g, low birth weight is 2500-1500 g, very low birth weight is 1500 - 1000 g, and extremely low birth weight is 1000-500 g.

A fetus that is too large or small at birth may have experienced intrauterine growth restrictions (IUGR). Fetuses that are small for gestational age (SGA) or large for gestational age (LGA) occur in 3-10% of births. Babies with SGA or LGA are 4-8 times more likely to expire before birth and are 5-10 times more likely to suffer neurological issues.

http://blogs.discovermagazine.com/80beats/files/2009/10/fetus-ultrasound1.jpg

Causes of Abnormal Fetal Development

There are many possible causes of abnormal fetal size and weight. A few examples include:

- Gestational age
- Maternal age and race
- Environmental factors such as maternal nutrition
- Pregnancy weight (over or under)
- Birth defects or chromosomal abnormalities
- Drug, cigarette, or alcohol use
- Pregnancy hypertension and/or diabetes
- Placental, umbilical, or uterus abnormalities
- Pregnancy complications
- Multiple pregnancy (twins, etc.)
- Sex of the fetus

Risks of Abnormal Fetal Development

At delivery, a smaller than normal fetus is at risk of hypoxia, meconium aspiration, hypoglycemia, polycythemia, hyperviscosity, motor disruption, or neurological dysfunction. A larger than normal fetus is at risk of injury at birth and may experience intrapartum asphyxiation, shoulder dystocia, injuries to the brachial plexus, and bone injuries. The mother is also at risk of postpartum hemorrhage and injuries to the birth canal or pelvic floor. Cesarean section is more common for fetuses of larger size.

APA. 2007. Fetal Growth Restriction; Intrauterine Growth Restriction (IUGR); Small for Gestational Age. American Pregnancy Association, www.americanpregnancy.org.

Lobo, I. and Zhaurova, K. 2008. Birth defects: causes and statistics. Nature Education 1(1).

Robin, S. 2010. Abnormal Growth of the Fetus. www.livestrong.com.

Materials

Ruler
4 Colors: pen/marker/pencils

Procedure

Scenarios

Patient 1 – Jenny Johnson

Jenny & Jason Johnson have been trying to conceive for a year and were able to do so with your help to control Jason's Celiac disease. Jenny is currently 24 weeks pregnant.

Patient 2 – Anna Ashton

Anna & Arnold Ashton are an older couple that were able to conceive after the conclusion of Arnold's chemotherapy treatments and fertility drugs presribed by Anna. Anna is currently 34 weeks pregnant.

Patient 3 – Karen Klaus

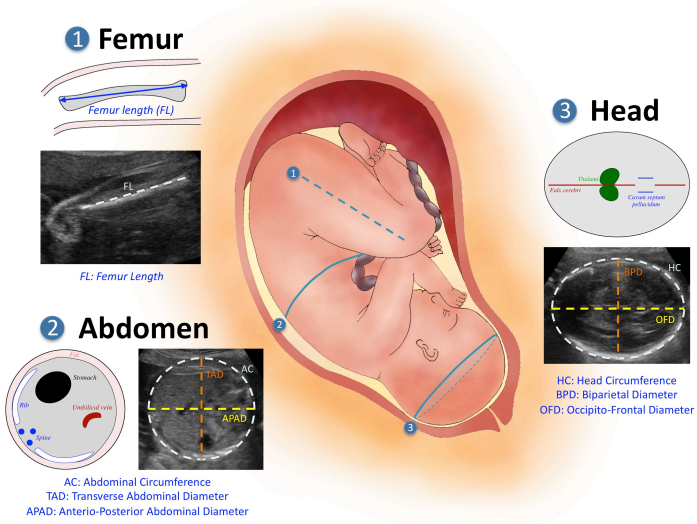
Karen & Kevin Klaus have been trying to get pregnant for 6 months and, with your help to diagnose and treat Karen's endometriosis and Kevin's varicoceles, they were able to conceive through in vitro fertilization. Karen is currently 21 weeks pregnant.

Update: Tina & Thomas Tinkerson

You were also treating Tina & Thomas Tinkerson who have been trying to conceive for three years. Tina has had two miscarriages within that 3-year period. Tina had surgery to remove several of the largest cysts on her ovaries caused by polycystic ovary syndrome, but has still not been able to conceive. They are unable to afford in vitro fertilization, and are instead looking into adoption.

Procedure

You are the fertility specialist at HASPI Fertility Center, and you have been treating the patients above for infertility. Three out of four of your patients have been able to conceive and you are now overseeing their pregnancies. During a routine ultrasound, several measurements of each fetus are taken to determine normal or abnormal growth. The length of the fetus from head to heel, weight, femur length, head circumference, and abdomen circumference are the most common measurements. The measurements from the ultrasounds are summarized in Table 1.



http://www.biomedicalimaging.org/2012/images/5.jpg

Table 2 notes the average measurements for fetal development for comparison purposes with the patient ultrasounds. To make it easier for your patients to interpret their results, you are going to create a line graph of the normal measurements for average fetal development with each patient's data for comparison.

Table 1. Actual Fetal Development						
	Gestation *(weeks)*	**Weight** *(g)*	**Length** *(mm)*	**Head Circumference** *(mm)*	**Abdominal Circumference** *(mm)*	**Femur Length** *(mm)*
Patient 1: *Johnson*	24	300	260	179.6	150.0	34.7
Patient 2: *Ashton*	34	3726	513	347.1	331.9	76.5
Patient 3: *Klaus*	21	367	268	184.4	159.2	35.0

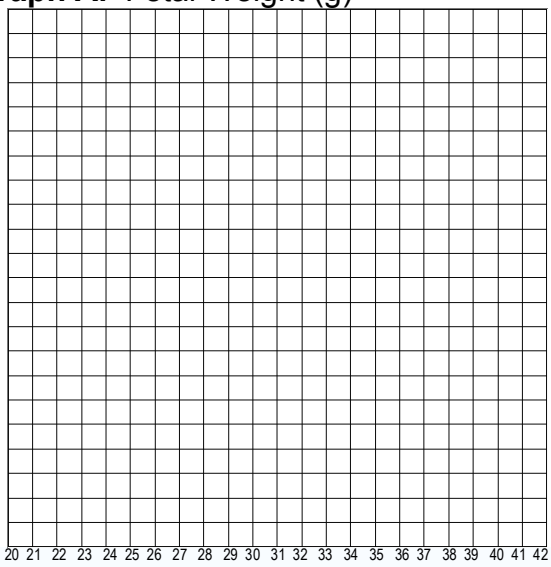
Table 2. Average Fetal Development					
Gestation *(weeks)*	**Weight** *(g)*	**Length** *(mm)*	**Head Circumference** *(mm)*	**Abdominal Circumference** *(mm)*	**Femur Length** *(mm)*
20	300	256	174.5	146.2	32.1
21	360	267	186.6	157.1	34.9
22	430	278	198.5	168.0	37.6
23	501	289	210.0	178.7	40.3
24	600	300	221.2	189.3	42.9
25	660	346	232.1	199.8	45.5
26	760	356	242.6	210.2	48.0
27	875	366	252.7	220.4	50.4
28	1005	376	262.5	230.6	52.7
29	1153	386	271.8	240.5	55.0
30	1319	399	280.7	250.4	57.1
31	1502	411	289.2	260.1	59.2
32	1702	424	297.3	269.7	61.2
33	1918	437	304.9	279.1	63.1
34	2146	450	312.0	288.4	64.9
35	2383	462	318.7	297.5	66.6
36	2622	474	324.8	306.4	68.2
37	2859	486	330.4	315.1	69.7
38	3083	498	335.5	323.7	71.1
39	3288	507	340.0	332.1	72.4
40	3462	512	344.0	340.4	73.6
41	3597	517	347.4	348.4	74.6
42	3685	515	350.3	356.2	75.6

Graphing Directions

✔when complete

Step 1	On the next page there are five graphs, one for each fetal measurement: weight, length, head circumference, abdominal circumference, and femur length.	
Step 2	For each fetal measurement, create a line graph from gestation week 20 – 42 on its respective graph. Be sure to label the "y" axes.	
Step 3	Choose a different colored marker/pen/pencil for each patient and color in the circle in the key for that patient.	
Step 4	Using the marker/pen/pencil for Patient 1, put a dot on "Graph A: Fetal Weight" at 24 weeks and a weight of 300 g. Repeat with each color for Patient 2 and 3.	
Step 5	Using the data in Table 1, place a dot on the remaining graphs for fetal length, head circumference, abdominal circumference, and femur length.	
Step 6	Answer the analysis questions using the graphs you have created.	

Graph A. Fetal Weight (g)



Gestation *(weeks)*

Legend

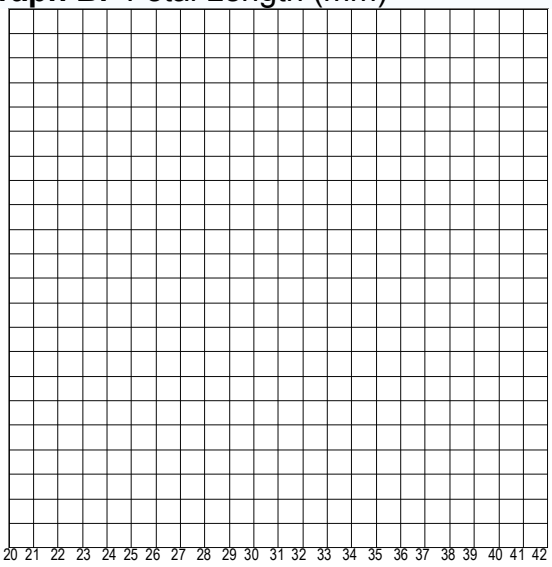
Average Measurements

Patient 1: *Johnson*

Patient 2: *Ashton*

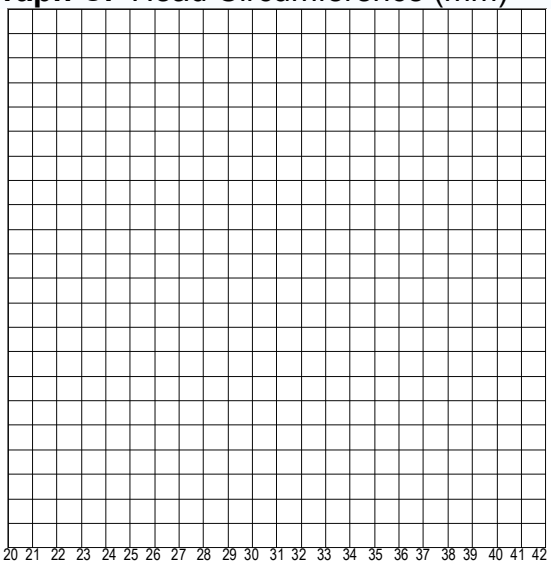
Patient 3: *Klaus*

Graph B. Fetal Length (mm)



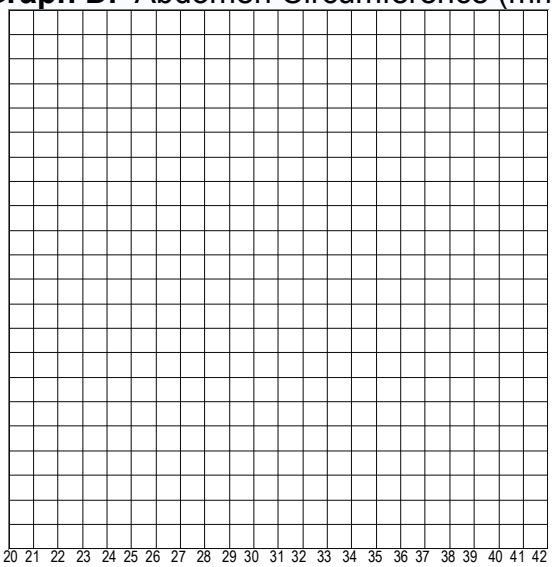
Gestation *(weeks)*

Graph C. Head Circumference (mm)



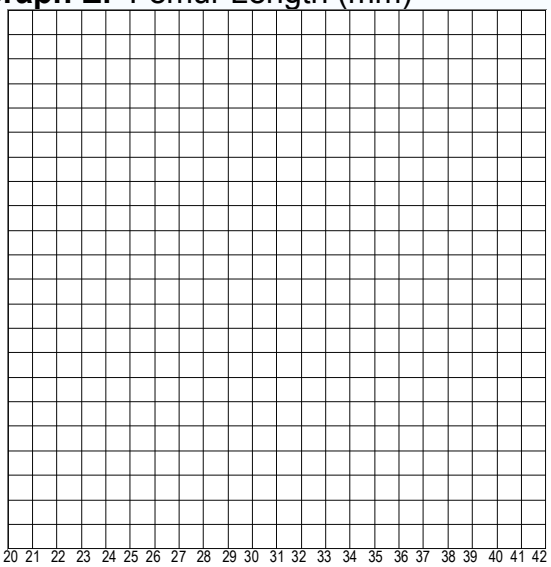
Gestation *(weeks)*

Graph D. Abdomen Circumference (mm)



Gestation *(weeks)*

Graph E. Femur Length (mm)



Gestation *(weeks)*

Analysis Questions - *on a separate sheet of paper complete the following*

1. For Patient 1, is the fetal birth weight normal, more, or less than the average? If it was high or low, by how much? At this point, is the fetus at risk of SGA or LGA? (remember + or - 500 g or more is a concern).
2. For Patient 2, is the fetal birth weight normal, more, or less than the average? If it was high or low, by how much? At this point, is the fetus at risk of SGA or LGA?
3. For Patient 3, is the fetal birth weight normal, more, or less than the average? If it was high or low, by how much? At this point, is the fetus at risk of SGA or LGA?
4. Create a chart that summarizes whether the fetal length, head circumference, abdominal circumference, and femur length is normal, high, or low for each patient (1, 2, and 3).
5. Which patient(s), if any, are you concerned about after comparing their fetal development to the average measurements? Why?
6. Figure 1 below shows the average fetus weight percentiles, for example, a fetus that weighs approximately 4186 g at 40 weeks is larger than 99% of other fetuses at the same gestational age. What weight percentile is Patient 1? Patient 2? Patient 3? (If the fetus is in between weight percentiles round to whichever percentile it is closest.)
7. What are the five most common fetal measurements used to determine fetal development?
8. **CONCLUSION**: In 1-2 paragraphs summarize the procedure and results of this activity.

Review Questions - *on a separate sheet of paper complete the following*

1. Why is it important to monitor the development of a fetus?
2. How are fetal measurements most commonly taken?
3. What is the healthy range for birth weight in grams? One pound = 453.6 grams. How many pounds is the healthy range for birth weight?
4. How much in grams is a high birth weight? What issues can occur with a LGA fetus?
5. How much in grams is a low birth weight? Very low birth weight? Extremely low birth weight? What issues can occur with a SGA fetus?
6. What percentage of fetuses born are SGA or LGA?
7. List at least 3 causes of abnormal fetal size and weight.

Figure 1. Weight Percentiles by Gestational Age

	Weight percentiles† for the local population										
Gestational age* (weeks)	99th	97th	95th	90th	75th	Mean	25th	10th	5th	3rd	1st
24	820	786	768	741	695	644	593	547	520	502	468
25	957	918	897	865	812	752	692	639	607	586	547
26	1110	1064	1040	1003	941	872	803	741	703	679	634
27	1278	1225	1198	1155	1083	1004	924	853	810	782	730
28	1461	1401	1369	1320	1238	1147	1057	975	926	894	834
29	1658	1590	1554	1498	1405	1302	1199	1106	1051	1015	947
30	1869	1792	1751	1689	1584	1468	1352	1247	1184	1144	1067
31	2091	2005	1960	1890	1773	1643	1513	1395	1325	1280	1194
32	2324	2228	2178	2100	1970	1825	1681	1551	1473	1422	1327
33	2564	2459	2403	2317	2173	2014	1854	1711	1625	1569	1464
34	2809	2694	2632	2538	2381	2206	2032	1874	1780	1719	1604
35	3056	2930	2864	2761	2590	2400	2210	2039	1937	1870	1745
36	3301	3165	3093	2983	2798	2593	2387	2203	2092	2020	1885
37	3540	3395	3318	3199	3001	2781	2561	2362	2244	2167	2021
38	3770	3615	3533	3407	3196	2961	2727	2516	2390	2308	2153
39	3987	3823	3736	3603	3380	3132	2884	2660	2527	2440	2276
40	4186	4014	3923	3783	3549	3288	3028	2794	2653	2562	2390
41	4365	4185	4090	3944	3700	3428	3157	2913	2766	2671	2492

http://ars.els-cdn.com/content/image/1-s2.0-S0140673611603644-gr2.jpg