

A Comparative Study Of The Effect Of BMI On Labour Outcomes, Delivery Process, And Postpartum Women's Health, At Governmental Hospitals In Two Libyan Cities

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Abstract – This clinical study was carried out on postpartum women in two public hospitals during mid-2020. Analysis of collected data was done by using Descriptive statistics (frequencies and percentages Inferential statistics (X2-test &t-test), p-value less than 0.05 considered to be statistically significant. The 95% confidence interval was used to estimate a value range for an unknown parameter. The results of comparison between average age, height, weight, and body mass index characteristics of postpartum women for overweight and normal-weight groups in the study areas were addressed, there was no statistical significance at p 0.05 except for the weight and height variables in the normal- weight group, which in turn showed statistically significant differences. On the other hand, the results of labor induction and cesarean delivery were statistically significant in overweight and obese group compared to normal weight in the studied community at Zawia Hospital, where (Chi-square value = 13.52, p <0.00, 95% CI of OR = 3.702 (1.818, 7.541) And (Chi-square value = 63.43, p <0.00, 95% CI of OR = (0.116 (0.054, 0.251)). In the same context, statistical analyzes showed that there is a statistical significance when induction of labor for women with normal weight compared to overweight And obese patients in Al-Galaa Hospital, and their values were (Chi-square value = 8.72, p <0.003, 95% CI of OR = 0.348 (0.171, 0.710).

Aim: This study aims to compare and investigate the effect of body mass index on labour outcomes at two Libyan city hospitals in mid-2020.

Keywords – BMI, Labour Outcomes, Delivery, Postpartum Women.

I. INTRODUCTION

The period of pregnancy is a biological complicated process in women's life and related to physiological body changes, and plays an important role in homeostatic of various functional systems in the pregnant body and needs of the embryo [4]. After conception, the growth of the fetus occurs rapidly by each week with changes in several systems to cause adaptation of the maternal body to the growing fetus. All metabolic processes in pregnant women require anatomical and physiological changes, for adaptation mum's body with a new state [14]. The digestive system changes in pregnancy, Pregnant women need to know that they may be suffer increased appetite and consumption of food during pregnancy to meet increased nutritional requirements Women should be informed about trouble digestive system symptoms such as heartburn, vomiting, constipation, and nausea during pregnancy , all these for easy adaption during pregnancy[2].Changes occur in the parameters of physiologic to protect the maternal and support fetal growth only to return to the pre-pregnancy levels after the baby labour[4]. In fact, the female body naturally changes during pregnancy, and in many cases, these changes occur normally; however, there may be imbalances that make a pregnant woman susceptible to physical and psychical problems such as weight gain (gestation weight gain) that can cause complications or

pathologies during pregnancy or postpartum [4, 19]. **Obesity and weight gain** are conditions characterized by increase accumulation of body fat, frequently resulting in significant impairment of health and endurance [23]. It is becoming a general problem affecting health especially in low- and middle-income communities of all ages around the world [3]. World Health Organization (WHO) and the National Institutes of Health determined weight with body mass index ($BMI = \text{weight}/(\text{height})^2$; where BMI of underweight, normal-weight, overweight, and obese are less than 18.5; 18.5-24.9, 25-29.9, and 30 or greater respectively [11]. Obesity is classified into obese class I, obese class II, and class III [10,21]. WHO published about 40% of women have overweight and 15% have obese in women aged 18 years and older in 2016, with a world forecast of about 70 million babies who are overweight under aged 5 years in 2025[10, 26]. Few studies In the united state of America published on the development of mothers obesity and its complication in past years, 31.8% of women aged 20–39 years were obese in 2011–2012, and increasing obesity rates, especially class III obesity, have increased significantly between 2005 and 2014[21]. A mother's pre-gestation BMI is known to affect pregnancy and childbirth results. women who have underweight before pregnancy is at increased risk for premature labor, small gestational age(SGA), and low birth weight, also associated with adverse health in adulthood, coronary heart disease, insulin resistance, and hypertension [20]. On the other widespread obesity and weight gain in women childbearing age has reached epidemiological rate around global [18, 27]. Obesity has an impact on short and long-term general health for both maternal and child. Weight gain and obesity before pregnancy, during pregnancy, prenatal and postpartum have negative consequences include menstrual cycle dysfunction, ovulation and infertility before pregnancy, preeclampsia, hypertension and gestational diabetes (GDM) during pregnancy, cesarean delivery [27]. Also in the postpartum period, they are at a higher risk of thromboembolism, postpartum depression, and ineffective breastfeeding.

The inability of physical movement, large breast tissue, and delay in the secretion of lactogenesis II., were the major important obstacles in starting and sustaining breastfeeding for overweight and obese mothers [11, 17]. For newborns, there is an increased risk of Macrosomia, stillbirth, and admission to a neonatal care unit. In the long term, babies of obese mothers suffer from impaired metabolic in utero (fetal programming) and premature death from cardiovascular disease as well as neurocognitive developmental problems [15, 23].

II. METHODOLOGY

Study Design and Study Period

The study consisted of body measurements and a cross-sectional clinical medical condition for each member of the study population, in addition to conducting various statistical analyzes related to those measurements. The study was focusing on the health status of pregnant women during labor, delivery, and postpartum woman, at the government hospitals located in two cities Al-Zawia and Tripoli in the state of Libya. The total duration of the fieldwork for this study was two months in mid-2020.

Sampling Technique and Sample Size

During the study period, an average of eighteen and twenty-one pregnant women attended daily the Al- Zawia and Al-Galaa hospitals, respectively. The samples were taken randomly a week by week shifting between Al-Zawia hospital and Tripoli (Al-Galaa) hospital respectively for a couple of months. Before measuring body weight and height for each patient, his medical file was received to view and transmit the data needed for this study. The sample size was 150 and 168 postpartum women from Al-Zawia and Tripoli Hospitals, respectively. Those who were underweight were few, so their measurement values were excluded, and the sample sizes would be 139 and 155, respectively.

Collection of Clinical Information

The medical files contain all the data related to the health of the pregnant woman, especially during the period of labor, childbearing, and the outset period of postpartum. It is a source of several medical points about the cases of elective and emergent delivery and normal vaginal birth.

Anthropometric Measurement

1. **Bodyweight:** An electronic weight machine was used to measured body weight. The weight was recorded barefooted and the scale was calibrated to zero marking every time before use. The weight was recorded in kilogram.

2. Height: The height of each member of the study population was measure in a standing position hanging by the side and barefooted, relaxed way, the vertebral column touching the scale. Height was measured to the nearest 0.1 cm.
3. BMI: Measurement of Body Mass Index (BMI) as the best way to measure the nutritional and health status of a pregnant woman, an adult BMI chart as shown in figure 1 and an internet calculator were used [7,8].

Data Analysis

The data set was first checked, cleaned, and entered into the computer from the numerical codes on the form. The data was edited if there is any discrepancy and then cleaned. The frequency distributions of the entire variables were checked by using IBM SPSS 22, windows program. For tabular, figures, and a graphical representation, Microsoft word and Microsoft excel 2007 were used.

Statistical analysis

The student's t-test for independent samples was used for the analysis of continuous variables. Heterogeneity chi-square test or Fisher's exact test (if numbers were small) was used to compare categorical variables. A P-value of ≤ 0.05 was considered statistically significant. Binary logistic regression was used to evaluate the odds ratio. All the analyses were carried out using was used IBM SPSS Statistics 22 & Microsoft office excel 2007.

III. RESULTS

In the light study, a total of 318 postpartum women were included in Al-Zawia and AL-Galaa Teaching Hospitals. The sample size was 150 and 168 postpartum women from Al-Zawia and Tripoli Hospitals, whereas the distribution of the sample according to body mass index and classified into 11/150 (7.33%) and 13/167 (7.74%) in underweight, 48/150 (32.00%), and 89/168 (52.97%) as normal-weight, 64/168 (42.67%) and 44/168 (26.19%) overweight, 27/150 (18.00%) and 22/ 168 (13.10%) were obese respectively. as shown in table 1. The distribution of our study samples was classified and presented in table 1. Although many classes were presented in underweight, normal-weight, and overweight and obese. However, underweight was the small percentage of the total population of a study area (7.33%), (7.74%), thus they were excluded from the analysis. Also, the obese group percentage (18.00%), (13.10%) was added to the overweight. The association between categorical variables at Al-Zawia and AL-Galaa Hospitals was observed statistically significant in our study by using the Chi-square test (Chi Square=15.448, p-value =0.000) as shown in table 2. During the study period, the maternal ages ranged from 18- 42 years, and they were divided into five statistical categories : (18-22) 12% of Al-Zawia hospital and 17.27% of AL-Galaa hospital, (27-23), (28-32), (33-37) and (38-42) and their percentages were 24%, 21.43%, 26.66%, 32.14%, 20.67%, 18.45%, 16.76%, and 10.17% respectively. The higher proportion of the study population, (26.66%) in Zawia hospital and (32.41%) in AL-Galaa hospital in the age group between 28-32 years as shown in figure 1.

There were no significant differences of Al-zawia hospital postpartum women's parameters of age, weight, Height and BMI values ($p < 0.064$, $p < 0.128$, $p < 0.743$ and $p < 0.740$ and 95% CI = (-0.057, 1.951), (-0.241, 1.894), (-1.858, 2.598), and (-0.675, 0.947) , also AL- galaa hospital postpartum women's values ($p < 0.870$, $p < 0.162$, $p < 0.712$ and $p < 0.144$ and 95% CI= (-0.845, 1.009), (-0.194, 1.563), (-1.456, 2.259), and (-0.176, 1.202), respectively as shown in table 3 . In table 4, there was no significant association between age, height, weight, and BMI in the overweight group, when compared to the normal-weight group. While the normal-weight group shown a significant difference in height and weight parameters (p-value = 0.000 ,P value= 0.007) respectively in both study area as shown table 5. In present study areas, the labour induction in normal-weight group were 27.1% (n=19), overweight & obese were 72.9% (n=51) ,vaginal delivery 96.4% (n=43) normal-weight , 30.6% (n=19) Overweight & obese , while the cesarean section normalweight group were 20.8% (n=16), 79.2% (n=61) Overweight & obese in Al-Zawia hospital .The results of labour induction and caesarean delivery were statistically significant in overweight and obese compared to the normal-weight in the at Al-Zawia Hospital group (chi-square value=13.52, p-value = ≤ 0.00 and (chi-square value=63.43, p-value= ≤ 0.00) for labour induction and caesarean delivery respectively . In Tripoli hospital, among 77.9%(n=53) of women had labour induction in normal weight, 22.1% (n=15) overweight & obese group, vaginal delivery 80.0% (n=56) normal-weight 20.0 % (n=14) Overweight & obese. In the same context, caesarean delivery in the normal weight group were 52.9% (n=45), 47.1% (n=40) overweight & obese group. In the AL-Galaa hospital population, there is a significant increase, there is a significant increase in labour induction and Caesarean section delivery as BMI increases Chi-square: 8.72, P-Value =0.003, Chi- square:12.381, P-Value =0.000 in this study areas

respectively. Statistically, a significant increase has been noticed in labor induction and operative delivery with increasing BMI in both study areas as shown in tables 6,7. In figure 3, the results show an increased percentage of Caesarean section (58.27%, 53.55%) and decreased normal deliveries (41.73%, 64.45) in maternal women who were overweight and obese as compared to normal-weight women at Al-Zawia and Al-Galaa Hospital respectively. Weight gain and obesity were associated with increased risk of emergency and elective cesarean delivery (32.67%, 34.84%) and (25.18%, 27.105) respectively in Al-Zawia and Al-Galaa hospitals higher than normal delivery as shown in figure 4.

Table (1) Distribution of the sample according their BMI.

Category	BMI range kg/m ² for adults	Percentages Patients BMI			
		postpartum women of Zawia Hospital		postpartum women of Tripoli Hospital	
		Number	Percentage	Number	Percentage
Underweight					
• Severe Thinness	< 16	1	0.67%	1	0.60%
• Moderate Thinness	16 - 17	2	1.33%	2	1.19%
• Mild Thinness	17 - 18.5	8	5.33%	10	5.95%
Normal	18.5 - 25	48	32.00%	89	52.97%
Overweight	25 - 30	64	42.67%	44	26.19%
Obese Class I	30 - 35	15	10.00%	13	7.74%
Obese Class II	35 - 40	10	6.67%	8	4.76%
Obese Class III	> 40	2	1.33%	1	0.60%

Table (2) Statistical independence for population of two study area.

BMI measure	Over + Obese weight	Normal weight	Under weight	Sum	Chi square	p- value
Location						
Zawia Hospital	91	48	11	150	15.448	0.000
Al-Galaa Hospital	66	89	13	168		
Sum	157	137	24	318		

Table (3) Characteristics of patients the different BMI groups, (over and normalweight).

Characteristic		Overweight Mean(± SD)	Normalweight Mean(± SD)	T -test	P- valu e	95% CI of Mean difference	
						Lower	Upper
Age	Zawia Hospital	)±5.82(31.24	)±6.40(28.17	1.864	0.064	-0.057	1.951
	Al-Galaa Hospital	)5.65(±27.15	)5.58(±31.89	0.164	0.870	-0.845	1.009
Body Height	Zawia Hospital	)6.69(±161.13	)6.46(±159.60	1.530	0.128	-0.241	1.894
	Al-Galaa Hospital	163.46(±5.55)	163.73(±6.21)	1.538	0.162	-0.194	1.563
Body Weight	Zawia Hospital	)9.94(±78.44	70.37(±13.81)	0.328	0.743	-1.858	2.598
	Al-Galaa Hospital	)10.02(± 79.46	)6.21(±63.09	0.370	0.712	-1.456	2.259
BMI	Zawia Hospital	)3.70(± 30.08	)1.69(±23.58	0.332	0.740	-0.675	0.947
	Al-Galaa Hospital	)3.69(±29.77	)1.33(±51.23	1.470	0.144	-0.176	1.202

Table (4) A comparison of the characteristics of the overweight group in the two study areas.

Characteristics		Mean($\pm$ SD)	T test	P - value	95% CI of Mean difference	
					Lower	Upper
Age	Zawia Hospital	31.24($\pm$ 5.82)	0.709	0.479	-2.479	1.169
	Al-Galaa Hospital	31.90($\pm$ 5.58)				
Weight	Zawia Hospital	78.44($\pm$ 9.94)	-0.634	0.527	-4.196	2.158
	Al-Galaa Hospital	79.46($\pm$ 10.01)				
Height	Zawia Hospital	161.13($\pm$ 6.69)	-2.478	0.140	-4.667	-0.529
	Al-Galaa Hospital	163.73($\pm$ 6.21)				
BMI	Zawia Hospital	30.08($\pm$ 3.70)	0.513	0.608	-0.871	1.483
	Al-Galaa Hospital	29.78($\pm$ 3.69)				

Table (5) Comparison of patient characteristics with the normalweight group in the two study areas.

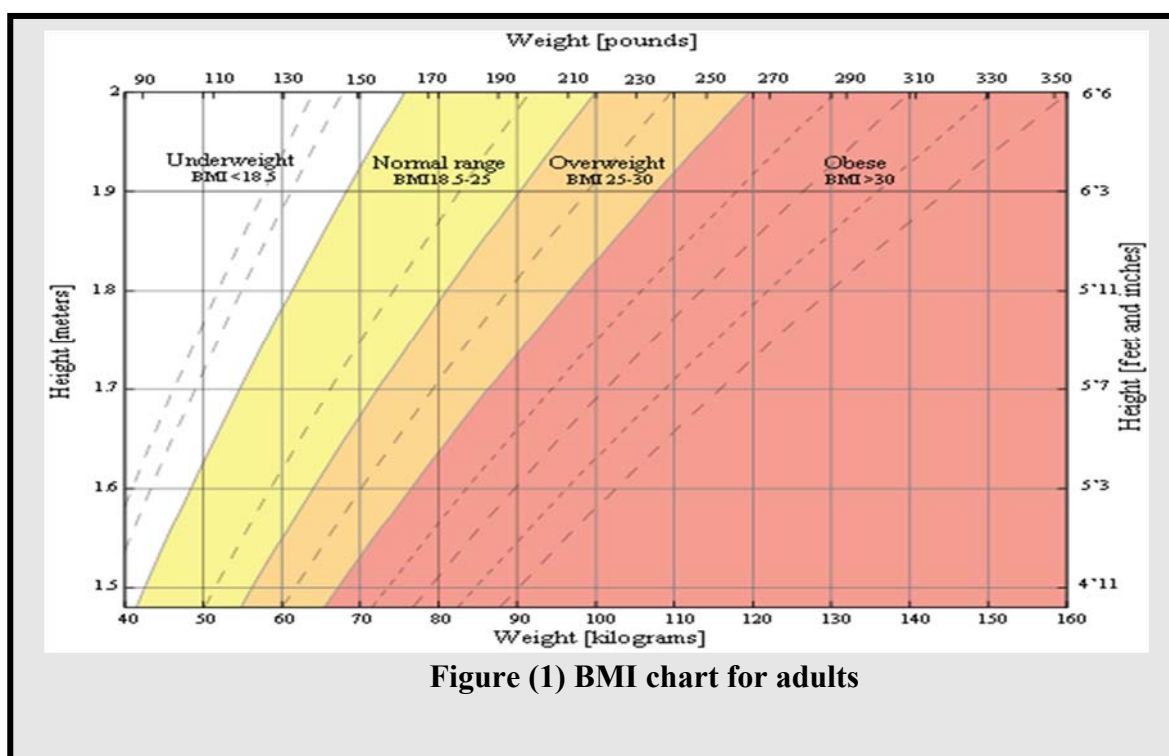
Characteristics		Mean($\pm$ SD)	T test	P- value	95% CI of Mean difference	
					Lower	Upper
Age	Zawia Hospital	28.17($\pm$ 6.40)	0.951	0.343	-1.089	3.108
	Al-Galaa Hospital	27.16($\pm$ 5.65)				
Weight	Zawia Hospital	59.96($\pm$ 6.69)	-2.741	0.007	-5.386	-0.871
	Al-Galaa Hospital	63.09($\pm$ 6.02)				
Height	Zawia Hospital	159.60($\pm$ 6.46)	-3.669	0.000	-5.941	-1.772
	Al-Galaa Hospital	163.46($\pm$ 5.55)				
BMI	Zawia Hospital	23.51($\pm$ 1.69)	0.022	0.982	-0.513	0.525
	Al-Galaa Hospital	23.51($\pm$ 1.33)				

Table (6) Tripoli hospital : Labour and delivery outcomes

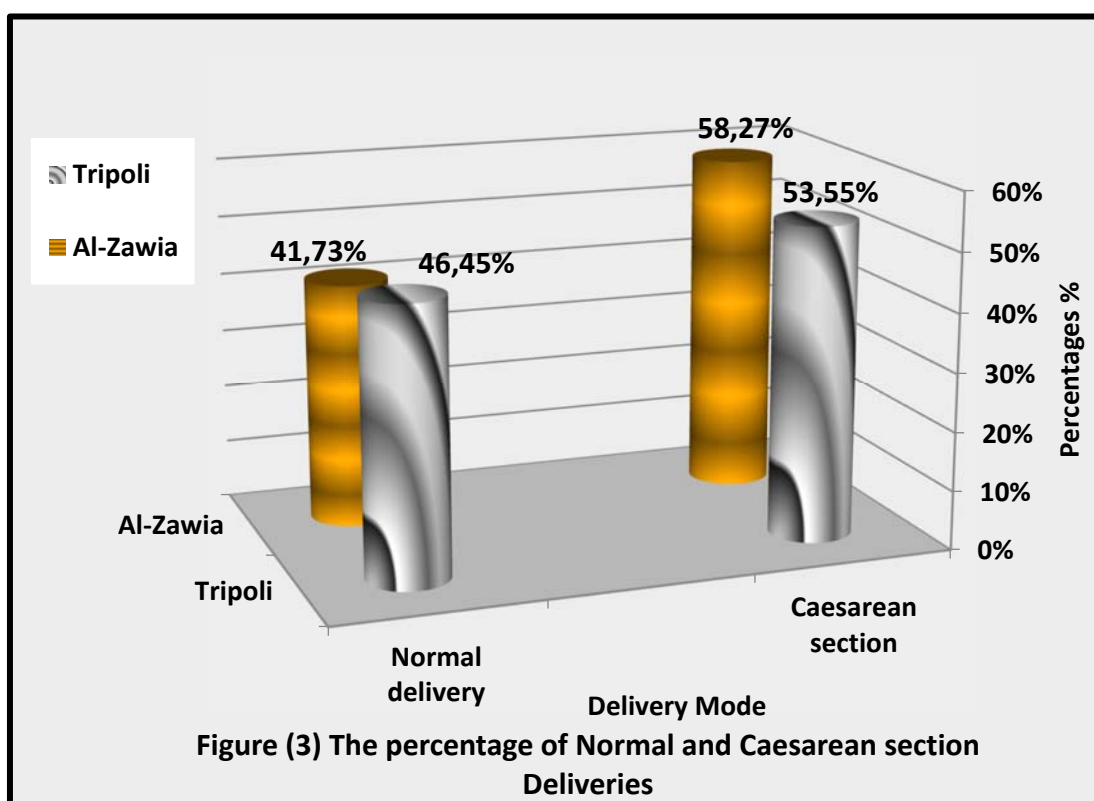
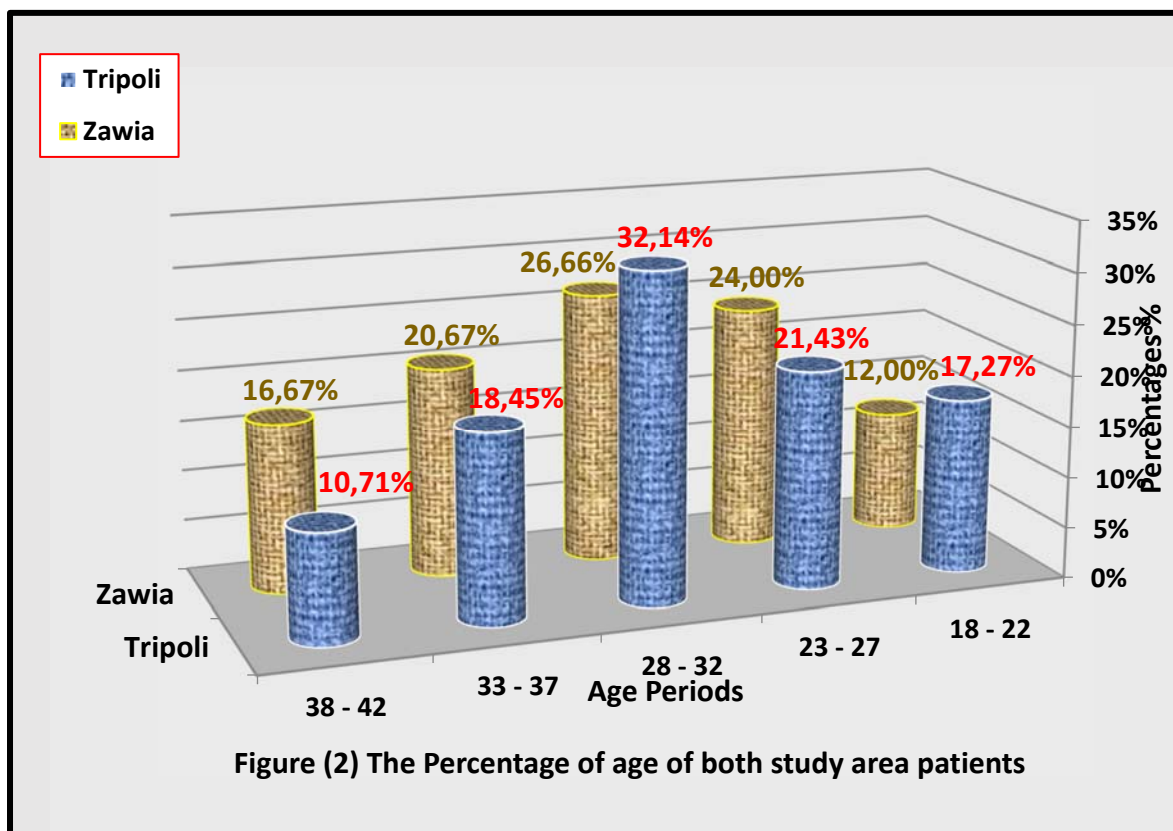
	Normal (BMI = 18.6- 25.0)	Overweight + Obese (BMI ≥ 25.1)	Chi square	p-value	Odds Ratio, 95% CI of OR
N = 101 (65.16%)		N = 54 (34.84%)			
Labour and delivery outcomes					
Labour					
• Spontaneous	48 (52.2%)	39(44.8%)	8.72	0.003	0.348(0.171 , 0.710)
• Induced	53 (77.9%)	15(22.1%)			
Delivery					
• Spont. Vaginal	56(80.0%)	14(20.0%)	12.381	0.000	0.281 (0,136, 0.580)
• Caesarean section	45(52.9%)	40(47.1%)			
• Vacuum/forceps					

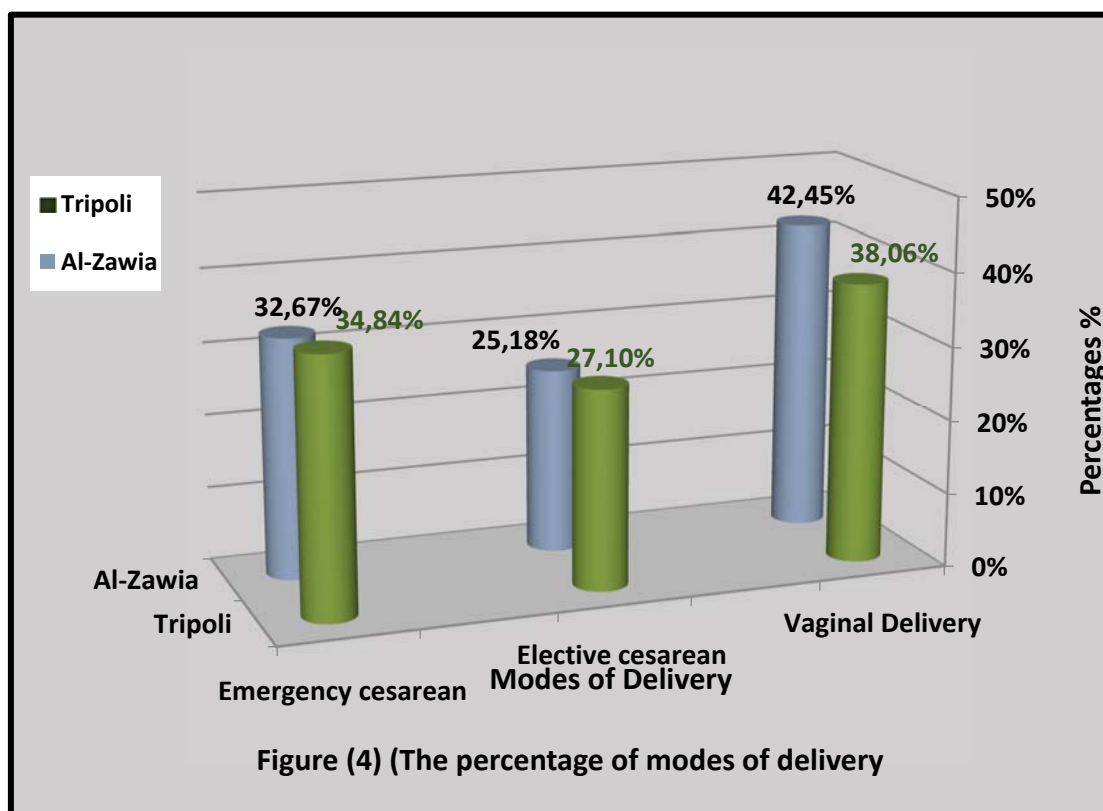
Table (7) Zawia hospital: Labour and delivery outcomes

	Normal (BMI = 18.6- 25.0)	Overweight + Obese (BMI ≥ 25.1)	Chi square	p-value	Odds Ratio, 95% CI of OR
N = 59 (42.45%)		N = 80 (57.55%)			
<i>Labour and delivery outcomes</i>					
<i>Labour</i>					
• Spontaneous	40(58.0%)	29(42.0%)			
• Induced	19(27.1%)	51(72.9%)	13.52	0.00	3.702(1.818, 7.541)
<i>Delivery</i>					
• Spont. Vaginal	43(96.4%)	19(30.6%)			
• Caesarean section	16(20.8%)	61(79.2%)	63.43	0.00	0.116 (0,054 , 0.251)
• Vacuum/forceps					



Source [8]





IV. Discussion

Obesity is one of the major health problems in the world, it has become a global epidemic. WHO has declared obesity as a major killer disease of the millennium on par such as HIV and malnutrition [13]. BMI anthropometric measurement scale for classifying obesity and overweight in mothers Body Mass index (BMI) is one of the most widely used indicators anthropometric assessment of a pregnant woman [1,25]. According to the Institute of Medicine (IOM) and National Research Council (NRC) guidelines, the optimal weight gains for underweight is 12.7 – 8.1kgs and for obese is 5 – 9.1kgs. Both extremes and excessive or inadequate gestational weight gain can lead to adverse pregnancy outcomes [12].

In the current study, the population BMI was distributed into four groups according to WHO. They were 11/159 (7.33%) and 13/168 (7.74 %) of women are classified as underweight in both hospitals. Also 48/150 (32.00 %) and 89/168 (52.97 %) as normal-weight, 64/150 (42.67 %) and 44/168 (26.19 %) overweight, 15/150 (10.00 %) and 13/168 (7.74 %) as obese I, 10/150 (6.67 %) and 8/168 (4.76 %) as obese II, 2/150 (1.33 %) and 1/168 (0.60 %) obese III as shown in table 1 . The underweight group at Al-Zawia and AL- Galaa Hospitals was a small fraction of the total population of each study area, thus they were excluded from the analysis, also the number of the obese group was added to the overweight in this study. Correlation between categorical variables of the two study areas in table 2, was observed statistically significant difference at $p \leq 0.05$ by using the Chi-Square test (Chi-square-value = 15.448, and p-value = 0.00). The most significant differences that support our study were the population of two hospitals related to each other. In the same context, Obaid Alwan 2016 showed that the people of northwestern Libya have similar food habits and traditions, and these similarities are the type and quality of food, methods of preparation, and the pattern of consumption [16]. In light of the current study, all the characteristics of the postpartum women groups in Al-Zawia and Al-Galaa hospitals indicate that there was no significant difference between their variables: age, height, body weight, and BMI values ($p < 0.064$, $p < 0.128$, $p < 0.743$ and $p < 0.740$ and 95% CI= (-0.057, 1.951), (-0.241, 1.894), (-1.858, 2.598), and (-0.675, 0.947), and for postpartum women of Al-galaa were ($p < 0.870$, $p < 0.162$, $p < 0.712$ and $p < 0.144$ and 95% CI= (-0.845, 1.009), (-0.194, 1.563), (-1.456, 2.259), and (-0.176, 1.202), respectively as shown in table 3.

Tables 4 and 5 showed the comparison between the mean characteristics age, height, weight, and BMI, of postpartum women for overweight and normal-weight groups in the study areas. There is no statistical significance at $p \leq 0.05$ except for the weight and height variables of the normal weight group, which in turn showed significant statistical differences ($p < 0.007$, $p < 0.000$) and 95% CI = (-5.386, -0.871), (-5.941, -1.772), respectively. Furthermore, the current study has been focused to demonstrate the effect of BMI on labour and mode delivery outcomes. The incidence of labour induction and cesarean delivery was increased with an increase in BMI. This observation was obtained by using the chi-square test. The results of labour induction and caesarean delivery were statistically significant in overweight and obese compared to the normal-weight in the studied population of Zawia hospital as shown in table 7 and figure2, where (Chi-square value=13.52, $p < 0.00$, 95% CI of OR = 3.702(1.818, 7.541) and (Chi-square value=63.43, $p < 0.00$, 95% CI of OR = (0.116 (0,054, 0.251). On the other hand, table 6 and figure2 showed that there is statistical significance, in labor induction for normal-weight women compared to overweight and obese at Al-Galaa Hospital where the values are (Chi-square value=8.72, $p < 0.003$, 95% CI of OR = (0.348(0.171, 0.710), while the statistical significance of cesarean delivery in the normal-weight compared to the overweight group was (Chi-square value=12.381, $p < 0.000$, 95% CI of OR = [0.281 (0,136, 0.580). Figure 4 shows the increase in the emergency and elective cesarean delivery at Al-Zawia and Al-Galaa hospitals population (32.67%, 34.84%) and (25.18%,27.105) respectively. Meanwhile vaginal delivery was higher in the Al-Zawia hospitals population higher than Al-Galaa hospital group.

According to other research groups [1,5,6,9,22,25], weight gain and obesity were significantly lower in normal vaginal deliveries and more in cesarean sections in overweight and obese women. The increase of emergency and elective cesarean deliveries were similar to what we found in this study, conversely, other studies disagree with our findings [17, 24].

V. CONCLUSION

Within the limits of this study, an association was found between the maternal body mass index (overweight and obesity) with outcomes of pregnancy complications, such as increased rates of labor induction and cesarean delivery. Although the clinical reproductive problems of pregnant women in the two study areas were not limited to overweight women, they appeared in the normal weight category. Where our study focused on the effect of body mass index on before, during, and after childbirth, so our study is still ongoing to show the effect of body mass index on a pregnant woman after childbirth (postpartum period). This study recommends the necessity of providing adequate counseling and health care for all women to maintain a normal weight, especially in childbearing age, to avoid complicated childbirth outcomes.

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