

Maternal Obesity a Global Health Problem and its Implications on Maternal and Fetal Health

Anjum Hashmi^{1*}, Jamil Ahmed Soomro², Zafar Iqbal³, Tahira Kousar Soomro⁴ and Khalid Saleem⁵

¹MPH, Community Health Officer, Department of Community Health, PRF Medical Center, Karachi, Pakistan

²MPH, MNCH District Officer, World Health Organization, Pakistan

³MPH, Senior lecturer, Jinnah Medical & Dental College, Karachi, Pakistan

⁴FCPS, Registrar, Department of Gynaecology and Obstetrics, Unit 1, Civil Hospital, Karachi, Pakistan

⁵MPH, Medical Superintendent, PINS Complex, Hospital Nalore, Islamabad, Pakistan

Abstract

Introduction: Obesity in pregnancy is associated with numerous ante partum complications and neonatal morbidity. Modest weight loss prior to pregnancy and reduced weight gain during gestation could bring substantial advantages to obstetric outcome.

Objectives: To compare maternal complications and labor outcome in obese and non-obese women

Methodology: It is a retrospective comparative study conducted at the Department of Gynaecology and Obstetrics, Unit 1, Civil Hospital, Karachi from Dec 2009 to Dec 2010. A sample size of 220 gravid women is selected by Non Probability Convenience sampling technique. In these 110 obese women as cases was compared with 110 non-obese women as controls, booked at <20 weeks of gestation and data was collected regarding maternal complication, mode of delivery and neonatal outcome by trained medical officers. Data was entered and analyzed by SPSS version 11.0 through descriptive analysis, chi-square test and independent sample t test. The p-values of <0.05 was considered significant.

Results: Pregnancy induced hypertension was present in 9 (8.2%) women in control group and 21(19.1%) in cases (p=0.0184). Gestational diabetes was seen in one (0.9%) in control compared to 8(7.3%) in obese women (p=0.0172). Obese women were found to be at increased risk of caesarean section [17 (15.5%) vs. 39(35.4%)] with significant p = 0.002. Apgar score at 1 and 10 minute was low in cases compared to controls (p=0.0001).

Conclusion: Obese women are at increased risk of pregnancy induced maternal obesity and associated with an increased risk of hypertension, gestational diabetes mellitus and severe adverse pregnancy outcome.

Keywords: Obesity; Nutrition; Women; Pregnancy; Postpartum; Obesity; Maternal health; Diabetes; Fetal health; Birth outcome; Pakistan

Introduction

The increasing prevalence of overweight and obesity among women of childbearing age is a growing public health. The average body mass index (BMI) is increasing among all age categories and women enter pregnancy at higher weights. Women are also more likely to retain gestational weight with each pregnancy. Women who are overweight (BMI 25–30) and obese (BMI ≥30) are at greater risk of adverse reproductive health outcomes compared to women of normal weight status (BMI 19.8–25) [1].

The increasing rate of maternal obesity provides a major challenge to obstetric practice. Maternal obesity can result in negative outcomes for both women and fetuses. The maternal risks during pregnancy include gestational diabetes and preeclampsia. The fetus is at risk for stillbirth and congenital anomalies. Obesity in pregnancy can also affect health later in life for both mother and child. For women, these risks include heart disease and hypertension. Children have a risk of future obesity and heart disease. Women and their offspring are at increased risk for diabetes. Obstetrician-gynecologists are well positioned to prevent and treat this epidemic [2].

Obesity is present in 35% of maternal deaths in the United Kingdom. Recent evidence show a doubling in the prevalence of obesity in young women attending for antenatal care in maternity hospitals in the UK (in some places, almost one in five are now obese) [3].

Marked obesity is a hazard to pregnant women and fetus. Hypertensive disorders, including pre existing hypertension and

pregnancy induced hypertension are more common in women with excessive weight although prevalence rates in different reports vary widely (7%-46%) [4]. Gestational diabetes affects 7%-17% of obese women; other problems associated with obesity include gallstones, urinary tract infections, post natal hemorrhage and possibly thrombophlebitis [5].

Obese women are more likely to give birth large for gestational age infants. Poor fetal growth is not usually seen in obese women. There is no clear evidence that obese women without prenatal complications is at increased risk for labor and delivery complications such as dysfunctional labor, shoulder dystocia and birth asphyxia [6]. There is conflicting evidence about the effect of obesity on perinatal mortality [5].

Various studies suggested that the caesarean section rate for obese women is slightly higher than that for women of normal weight [7].

Increasing obesity in the developed and under-developed world is

***Corresponding author:** Anjum Hashmi, MPH, Community Health Officer, Department of Community Health, PRF Medical Center, Karachi, Pakistan, Tel: 0092-332-317-1275; E-mail: anjumhashmi61@hotmail.com

Received December 07, 2011; **Accepted** January 12, 2012; **Published** January 14, 2012

Citation: Hashmi A, Soomro JA, Iqbal Z, Soomro TK, Saleem K (2012) Maternal Obesity a Global Health Problem and its Implications on Maternal and Fetal Health. Reproductive Sys Sexual Disord 1:103. doi:10.4172/2161-038X.1000103

Copyright: © 2012 Hashmi A, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

a pertinent issue with the escalating health and economic burden of obesity related diseases. The majority of public and research focus has been on chronic conditions such as heart disease, stroke, diabetes and cancer, which tend to affect the older population. However, overweight and obese pregnant women are known to be at increased risk of a number of important complications when compared to mothers with normal body mass index. These include increased pregnancy loss, increased medical and intrapartum complications [8]. Marked obesity is a hazard to the pregnant women and her fetus. In 1993 the American college of obstetrics and gynecologist released its BMI classification of maternal weight and optimal weight gain during pregnancy.

Maternal obesity has been associated with an increased risk for gestational diabetes mellitus. This increased risk is primarily related to an exaggerated increase in insulin resistance in the obese state [9]. Women who are obese during pregnancy and develop gestational diabetes have been shown to have a 2-fold increased prevalence of subsequent type 2 diabetes as compared to lean women [10]. Therefore maternal obesity is a significant long-term risk factor for type 2 diabetes [11].

Maternal weight and BMI have been validated as independent risk factors for pre-eclampsia [12].

Edwards and her colleagues showed there is an increased incidence of post-partum haemorrhage [13].

Obese gravidas have an increased incidence of labor induction as compared with their lean counterparts. Johnson et al showed there was significantly increased incidence of prolonged second stage of labor Oxytocin augmentation and failure to progress [14].

The primary Intra-partum complication of obesity is an increased risk for cesarean delivery, which is three; fold increased in obese women. Caesarean section in obese gravidas is associated with prolonged incision to delivery interval, blood loss > 1000 ml, longer operative times, wound infection, and Endometritis [15].

Obese gravidas are at higher risk for postpartum endomyometritis, laceration episiotomy infection and wound infection [16]. In Pakistan no data regarding incidence of obesity in pregnancy is available however data from the national health survey of Pakistan, 1990-1994 showed the prevalence of obesity (BMI>or=25kg/m²) in reproductive age (25-44years) is 14% for women in rural areas while in urban areas prevalence is 37% [17]. Perinatal mortality has increased two fold compared with the general population. In 1979, Sutherland and co-workers reported that obese pregnant women had an increased fetal loss compared with normal weight women, especially if the obese women developed gestational diabetes [18]. There are no studies in our country on the prevalence of obesity in pregnancy thus this topic for study was selected to know the prevalence, risk factors, and maternal and perinatal outcome in obese patients. Awareness of these risks can lead to heightened surveillance and diagnosis. Two practical interventions that may result in the most significant reductions are: Pre conception weight reduction and limitation of maternal weight gain in obese gravidas. We tried to evaluate the impact of obesity among pregnant women, its risk factors and their association with adverse labor outcomes.

Objectives

To compare maternal complications and labor outcome in obese and non-obese women.

Methodology

It is a retrospective comparative study conducted at Department of Gynaecology and Obstetrics Unit 1, Civil Hospital, Karachi from Dec 2009 to Dec 2010. To construct a 95% confidence interval with 5% error bound, the sample size was calculated by the following formula: $n = (Z_{\alpha/2})^2 p(1-p)/d^2$

A sample size of 220 gravid women is selected by Non Probability Convenience sampling technique. In these 110 obese women as cases was compared with 110 non-obese women as controls. The selection criteria was: Obesity is defined as body mass index of more than 29kg/m square ;Gestational diabetes mellitus is defined as fasting glucose level of > 8.mmol/l & 2 hour post glucose level > 11 mmol/l using a 75 g oral glucose tolerance test.(WHO 1980); Pregnancy induced hypertension is defined as hypertension and or proteinuria developing after 20 weeks of pregnancy, during labor or the puerperium in a previously normotensive nonproteinuric women (dew hurt's textbook of obstetrics and Gynecology).

Information regarding age, education, parity, BMI, booking gestation and gestation at the time of admission in labor ward maternal complications, pregnancy outcome and neonatal period was recorded and entered on redesigned Performa for each patient by research residents. The women were weighed and height measured at their first maternity care visit and mostly between 13 and 18 weeks of gestation. BMI was calculated as kilogram/meter squared and were grouped into obese (BMI>29 Kg/m²) and non -obese (BMI 19.8-26 Kg/m²). Maternal complications were noted such as pregnancy-induced hypertension, gestational diabetes, thromboembolic disease and others (urinary tract infections) .Any treatment received by women for these complications or for others was also noted. Onset of labor whether spontaneous or induced, duration of labor, mode of delivery were recorded. Status of newborn whether alive or dead, Apgar score recorded at 1 and 10 minutes in both groups, weight of baby measured in kilograms. Any need for neonatal intensive care admission was noted. Neonatal survival in 1st seven days and any congenital anomalies were observed.

Data was entered and analyzed by SPSS version 11.0 descriptive analysis i.e. mean and standard deviation for continuous variables (age of patients, duration of labor, etc) and frequency and percentage for categorical variables(ante partum complication, neonatal survival etc). The comparative analysis was calculated by using Chi-square test for categorical variables i.e.; maternal risk factors, mode of delivery, neonatal intensive care admission , labor outcome and independent sample t test for continuous variables i.e. duration of labor, birth weights and Apgar score. The p <0.05 was considered significant.

Results

The mean age of cases was 27.5 years while the mean age of control group was 25.7 years. Among cases 75 (68.2%) women whereas in controls 70(63%) women booked between 13 and 18 weeks of gestation.75(68.2%) obese women and 96 (87.3%) controls show no any ante partum complication which is statistically significant (p=0.0007). Pregnancy induced hypertension (PIH) was present in 21(19%) obese and 9(8.1%) among controls which is statistically significant (p=0.0184). Gestational diabetes mellitus (GDM) was present in 8 (7.2%) obese women and only in one (0.9%) woman in normal weight with a statistically significant (p=0.0172) (Table 1).

75(68.1%) obese women had spontaneous onset of labor and for 35 (31.8%) labor was induced but in the controls 89 (80.2%) went into spontaneous labor and in 21 (19%) women labor was induced which is

Ante partum Complications	Control (n = 110)	Cases (n = 110)	P-value
Pregnancy Induced Hypertension	9(8.1%)	21(19.0%)	0.0184
Gestational Diabetes Mellitus	1 (0.9%)	8 (7.2%)	0.0172
Thrombo-embolic Disease	0 (0%)	1 (0.9%)	0.3162
No complications	96 (87.2%)	75 (68.2%)	0.0007

Table 1: Comparison of ante partum complications (n = 220).

Birth weights (kg)	Non obese (n = 110)	Obese (n=110)	p-value
Mean	2.9	3.1	0.05
Standard deviation	0.4	0.7	
Median	2.9	3.3	
Range (min – max)	(1.4 – 4.5)	(1.0 – 4.6)	

Table 2: Comparison of birth weights (n = 220).

Neonatal admission	Non obese (n = 110)	Obese (n = 110)	p-value
Yes	6 (5.5%)	16 (14.5%)	0.0431
No	104 (91.5%)	94 (85.4%)	
APGAR Score at 1 min			0.0082
< 7	5(4.5%)	18 (16.3%)	
≥ 7	105 (95.5%)	92(87.6%)	
APGAR score at 10 min			0.0411
< 7	1 (0.9%)	8(7.2%)	
≥ 7	109 (99.1%)	102(92.7%)	
Neonatal Survival			0.0307
Yes	109 (99.1%)	103 (93.6%)	
No	1 (0.9%)	7 (6.3%)	

Table 3: Comparison of neonatal outcomes (n = 220).

statistically significant ($p=0.05$) (Table 2). The mean duration of labor in third stage in cases was 7.8 ± 8.0 minutes and in controls 5.7 ± 2.7 minutes, it is statistically significant ($p=0.01$). Regarding mode of delivery among the cases 68(61%) while in controls 84(76%) delivered by SVD and in cases 39(35.4%) delivered by LSCS whereas 17(15.4%) women in controls delivered by LSCS; which is statistically significant ($p=0.00$). There were no statistical difference in other modes of deliveries such as in spontaneous expulsion ($p=0.95$) and instrumental delivery ($p=0.12$). In cases the mean (standard deviation) birth weight of babies was $3.1(\pm 0.7)$ kg; maximum was 4.6 kg however in controls it was $2.9(\pm 0.4)$ kg. This difference in mean birth weight between two groups was statistically significant ($p=0.05$).

In control group all the births were alive but in obese cases 5 (4.5%) were perinatal deaths which is statistically significant ($p=0.03$). Among 105 live neonates born to obese women, 16 (14.5%) were admitted to neonatal intensive care unit (NICU) while among controls out of 110, six (5.4%) were admitted to NICU which is statistically significant difference ($p=0.02$). In cases, 2 (1.8%) neonates have shoulder dystocia and only 1 (0.9%) had it in controls. The infants with dystocia weigh between 3.2 - 4.5 kg.

In obese cases out of 105 babies, 18 (16%) babies had Apgar score less than 7 at 1 minute. Among normal weight control out of 110 babies; only 5(4.5%) had Apgar score less than 7 at 1 minute. This difference was statistically significant ($p=0.03$). In 105 obese mother babies, 8(7.2%) infants had Apgar score less than 7 at 10 minutes while in the control group only 1 (0.9%) baby had Apgar score less than 7 at 10 minutes which is statistically significant difference ($p=0.04$). In cases, 3 (2.7%) died during the early neonatal period compared to one in normal weight women which is not statistically significant. ($p=0.5$) (Table 3).

Discussion

Obesity is the commonest nutritional disorder at all ages in both

developing and non developing countries. The increased medical, surgical and anesthetic hazards of obesity are well known [19]. However there are relatively few studies of obesity in pregnancy. Our study supports that maternal obesity influence adversely maternal health and fetal outcome.

Though in our study, the maternal demographics did not show much difference between two groups, but the frequency of pregnancy induced hypertension (P.I.H) was considerably high in cases as compared to control women (19.1%vs9%) with ($p=0.01$). Sibai et al [20] who reported the incidence of PIH as 12.6%, ($p < 0.0001$), made similar observations. The results of our study are similar to that was reported by David and co-workers [21] in 2005 who found 12.6% of pregnancy-induced hypertension (P.I.H) in study of 364 women with a BMI >30 kg/m². This shows that obese women are more prone to PIH [22].

Maternal obesity is associated with increased risk of gestational diabetes mellitus (GDM). In our study the frequency of GDM is 7.3% in obese versus 0.9% in non-obese with ($p < 0.0001$) which is comparable with the data of Gross et al [23] who reported a 6.5% incidence of GDM.

In our study no significant difference was found between cases & controls regarding other maternal complications e.g. thrombo-embolic disease, P.I.H + GDM & urinary tract infections.

In our study the frequency of induction of labor in obese women was higher compared to non-obese women (32 % vs 19%). Similar positive association with maternal obesity was also observed by Kiran TSU et al [24] [105 (5.4%) OR=1.8 (1.1-2.9)].

In our study the mean durations of labor in 1st and 2nd stage were not statistically different between two groups. However the mean duration of 3rd stage of labor (5.7 Vs 7.8) in minutes ($p=0.01$) was statistically different between the two groups. These results are consistent with the results of study performed by Kiran TSU [24] results showed no difference in the duration of 1st & 2nd stages of labor between obese & controls.

The most common complication of obesity is an increased risk for cesarean delivery [25]. Both pre pregnancy obesity and excessive maternal weight gain contribute to an increased caesarean risk. Our study also supports this speculation because there is a significantly increased risk of caesarean section among cases compared to controls (37.3% vs 14.3%) with $p=0.0001$.

Obesity is associated with birth of a large for gestational age neonates. In our study the mean birth weights of newborn infants in cases was 3.1 ± 0.7 kg against a mean birth weight of $2.9 \pm$ in controls ($p=0.05$). In study by Le Thai and colleagues [26] showed obese women compared to normal weight women gave birth to infants, which were large for dates (3.7kg vs.3.2kg).

In our study the number of perinatal deaths increased from none in non-obese women to 5 of 110 in the offspring of obese women ($p=0.03$). Out of 5 deaths among obese mothers three were Preterm, one at term (intrauterine death) and one post term (early neonatal death). These results agree with the Kristensen J²⁸ who reported that obese women had more than twice the risk of stillbirth. (Odds ratio=2.8, 95% confidence interval[C I]: 1.5-5.3).

The Apgar score of 17 infants born to obese women at one minute was less than 7 compared to only 4 infants in controls with $p=0.000$. Apgar score at 10 minute between two groups was also statistically significant ($p=0.04$). These results are consistent with the Florence and colleagues reported low Apgar score in infants of obese mothers than

in infants of normal weight mothers. However in another study by Usha Kiran [24]. Apgar score at 5 minutes was not statistically different between obese and non-obese mothers.

In our study babies born to women with a (BMI >29) required more admissions to neonatal intensive care unit (NICU) compared to control group that is 17(11.5%) vs 6(5.5%) with $p=0.05$. Usha Kiran [24]. made similar observations.

Our study did not show increased risk of early neonatal deaths that is only one baby died during 1st 7 days in both groups ($p=0.50$). These results are in contrast to Kristensen J²⁸ who reported more than doubled the risk of neonatal death. (Odds ratio=2.6, 95% CI: 1.2-5.8).

Maternal obesity has been associated with an increased risk of congenital malformations. In our study no association between obesity and congenital malformations was seen.

Conclusion

The incidence of maternal obesity and its attendant co-morbid conditions (diabetes, cardiovascular disease) continues to increase at an alarming rate, with major public health implications. Not only does maternal obesity affect the woman, but it also impacts the health of the child, leading to increased childhood obesity and diabetes.

Author's Contributions

All the authors have (1) made substantial contributions to study conception and design, (2) been engaged in data analysis and interpretation of data, (3) been involved in drafting the manuscript or revising it critically for important intellectual content; and (4) have given final approval of the version to be published.

Acknowledgements

Our heartiest acknowledgements to Medical superintendent, Head of Department and Doctors of Department of Gynaecology and Obstetrics, Unit 1, Civil Hospital, Karachi for providing every possible administrative help.

Limitations

Result of this study cannot be generalized because this was performed in a tertiary care hospital. Confounders were not controlled in this study; future research on a large scale taking into account the confounding factors is required.

Recommendations

Policy should be made that BMI of all mothers must be calculated at booking as a part of the full risk assessment and should be offered advice about sensible weight reduction, including diet and exercise and referral to a dietician where appropriate. Moreover the midwives should inform mothers who are obese about how to recognize early warning signs of complications.

References

1. Siega-Riz AM, Siega-Riz AM, Laraia B (2006) The implications of maternal overweight and obesity on the course of pregnancy and birth outcomes. *Matern Child Health J* 10: 153-156.
2. Leddy MA, Power ML, Schulkin J (2008) The Impact of Maternal Obesity on Maternal and Fetal Health. *Rev Obstet Gynecol* 1: 170-178.
3. Ramsay JE, Greer I, Sattar N (2006) ABC of Obesity. Obesity and reproduction. *BMJ* 333: 1159-1162.
4. Drife JO (1986) Weight gain in pregnancy; Eating for two or just getting fat? *Br Med J* 293: 903-904.
5. Kleigman RM, Gross T (1985) Perinatal problems of the obese mothers and her infant. *Obstet Gynecol* 66: 299-306.
6. Robinson H, Tkatch S, Mayes DC, Bott N, Okun N (2003) Is maternal obesity a predictor of shoulder dystotia? *Obstet Gynaecol* 101: 24-27.
7. Garbaciak JA, Richter M, Miller S, Barton JJ (1985) Maternal weight and pregnancy complications. *Am J Obstet Gynecol* 152: 238-245.
8. Baetan JM, Bukusi EA, Lambe M (2001) Pregnancy complications and outcomes among overweight & obese nulliparous women. *Am J Public Health* 91: 436-440.
9. Catalano PM, Kirwin JP, Hangel-de Mouzon S, King J (2003) Gestational Diabetes and insulin resistance: role of short and long term implications for mother and fetus. *J Nutr* 133: 1674-1683.
10. O'Sullivan JB (1982) Body weight and subsequent Diabetes Mellitus. *JAMA* 248: 949- 952.
11. Metzger BE, Cho NH, Roston SM, Radvany R (1993) Prepregnancy weight and insulin secretion predict glucose tolerance five years after gestational diabetes mellitus. *Diabetes Care* 16: 1598-1605.
12. Sibai BM, Gordon T, Thom E, Caritis SN, Klebanoff M, et al. (1995) Risk factors for preeclampsia in healthy nulliparous women: a prospective multicenter study. The National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. *Am J Obstet Gynecol* 172: 642-648.
13. Edwards LE, Dickes WF, Alton IR, Hakanson EY (1978) Pregnancy in the massively obese-course outcome and obesity prognosis of infant. *Am J Obstet Gynecol* 131: 479-483.
14. Johnson SR, Kolberg BH, Varner MW, Railsback LD (1987) Maternal obesity and pregnancy. *Surg Gynecol Obstet* 164: 431-437.
15. Perlow JH, Morgan MA (1994) Massive maternal obesity and perioperative cesarean morbidity. *Am J Obstet Gynecol* 170: 560-565.
16. Goodall PT, Ahn JD, Chapa JB, Hibbard JU (2005) Obesity as a risk factor for failed trial of labor in patients with previous cesarean delivery. *Am J Obstet Gynecol* 192 : 1423-1426.
17. Nanan DJ (2002) The obesity pandemic implications for Pakistan. *J Pak Med Assoc* 52: 342-346.
18. Sutherland HW, Stowers JM, Fisher PM (1979) Detection of chemical gestational diabetes. In: *Carbohydrate Metabolism in pregnancy and the Newborn*. Springer-Verlage, Berlin.
19. Wildschut HI, James DK, Steer PJ, Weiner CP, Gonik B (2006) Prepregnancy Antecedent of a high risk pregnancy. In: *High risk pregnancy: Management options*. 3rd edn, WB Saunders, Philadelphia.
20. Sibai BM, Gordan T, Thom E (1995) Risk factors for preeclampsia in healthy nulliparous women: a prospective multicenter study. The National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. *Am J Obstet Gynecol* 172: 642-648.
21. Lumbardi DG, Barton JR, O'Brien JM, Istwan NK, Sibai BM (2005) Does an obese prepregnancy body mass index influence outcome in pregnancies complicated by mild gestational hypertension remote from term? *Am J Obstet Gynecol* 192: 1472-1477.
22. Barton JR, O'Brien JM, Bergaur N, Jacques DL, Sibai RM (2001) Mild gestational hypertension remote from term: progression and outcome. *Am J Obstet Gynecol* 184: 979-983.
23. Gross T, Sokal RJ, King KC (1980) Obesity in Pregnancy: risks & outcome. *Obstet Gynecol* 56: 446-450.
24. Kiran TSU, Hemmadi S, Bethal J, Evan J (2005) Outcome of Pregnancy in women with an increased body mass index. *Br J Obstet Gynecol* 112: 768-772.
25. Crane SS, Wojkwoycz MA, Dye TD (1997) Association between pre-pregnancy obesity and the risk of cesarean delivery. *Obstet Gynaecol* 89: 213-216.
26. Le Thai N, Lefebvre G, Stella V, Vauthier D, Foggia D, et al. (1992) Pregnancy and obesity . A case control study of 140 cases. *J gynecol Obstet Biol Reprod (Paris)* 21: 563-567.
27. Dereure FG, Boegner C, Jacques B (2000) Obesity and Pregnancy: Complication & Cost. *Am J Clin Nutr* 71: 242-248.
28. O'Brien E, Coats A, Owens P, Petrie J, Padfield PL, et al. (2000) Use and Interpretations of Ambulatory Blood Pressure Monitoring: Recommendations of the British hypertension society. *BMJ* 320: 1128-1134.