SCIENTIFIC ANALYSIS REVEALS MAJOR DIFFERENCES IN THE BREAST SIZE OF WOMEN IN DIFFERENT COUNTRIES

- U.S. women have a significantly larger mean breast volume than women born in other countries

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Abstract

In recent years the breast size (i.e., bra cup size and bra band size) of women has been studied in a number of national and regional research projects. Most of the studies have been conducted by universities in cooperation with companies within the lingerie industry and other commercial stakeholders.

However, the local studies have not been able to provide internationally comparable results regarding the factual breast size (i.e., breast volume or breast tissue volume) in different countries.

Increasing knowledge of the breast size variation of women from different countries is needed as a guideline for example for the product development and targeting of marketing actions of clothing industry and cosmetic surgery providers.

Recently a group of scientists made a thorough international data analysis with statistically reliable results. The breast size data of women born in 108 countries were converted to a comparable format and analyzed. The study analysis defined in a scientific way the average breast size of 28 – 30-year-old women broken down by country of birth. The analysis was based on accurately measured breast tissue volume of the women in the material. In order to facilitate the practical applicability of the study results the outcome of the final analysis was also expressed as bra cup sizes using the EU bra size standard as a reference.

The study analysis revealed that there is a considerable variation in the breast tissue volume, i.e., the factual bra cup size, of women depending on their country of birth. For example, women born in the U.S.A have by far larger breasts than women in any other country, while women born in Africa and Asia, particularly in the East Asian countries, have the smallest breast volumes.

Introduction

Breast size of women of different geographical origin has been a subject of common speculation throughout the modern history. The discussion concerning the correlation between women´s breast size and their geographical and ethnic origin has been ongoing ever since our ancestors began to travel. "In which country do women have the largest breasts?" has been a fairly common question asked by people in all times, including our own.

Teenagers are often openly interested in the factors that determine a woman's breast size. Also adults have been reported to pay a lot of attention to the variation of breast size, but they tend to hide their interest from their family, friends and colleagues in order to be socially correct.

People's natural interest in breast size variation is genetically driven as women´s breasts are the most obvious female secondary sexual characteristic which is of substantial importance from the perspective of social status and reproductive behavior.

Despite all the interest shown the availability of scientifically reliable data concerning the variation of breast size between the female populations of different countries has been quite limited until now.

The systematic work of our research team, in close cooperation with the local scientific resources in the countries, resulted in the most comprehensive material analysis ever conducted to study the factual breast volume variation of women born in different countries.

Although women´s breasts are undoubtedly a very significant female sexual characteristic and the populist interest in breast size is motivated by the sexual role of the breasts, the scientific community is interested in the geographic variation of breast size mainly for other reasons, namely the commercial ones. Knowledge of breast size variation is of major commercial importance for the clothing and entertainment industries.

Also the present breast size studies and the analysis conducted by our research team aimed to serve primarily the needs of international trade of underwear and standardization of garment sizing as well as the product development of the clothing industry.

Methods

Extensive international data collected and analyzed

Within the scope of the present study analysis an international research team went through and analyzed a substantial amount of measurement data collected in hundreds of national study projects.

The measurement data from the national studies, conducted by multiple companies and organizations all over the world, were collected and converted to a comparable format to be finally analyzed in a statistically reliable manner.

The primary parameter used to record the breast size of each woman was her factual breast tissue volume in ml (i.e., breast volume). In order to facilitate the practical applicability of the study results the outcome of the final volume analysis was also expressed as a bra cup size using the EU bra size standard as a reference.

In practice, the measured mean breast volume of the left and right breast of each woman was converted to a bra cup size ("A" to "F") based on her bra band size (cm). The bra cup size was recorded in accordance to the EU bra size standard. The EU standard defines the standard volume of each cup size from "A" to "F" for each band size.

Finally, a statistical analysis of the whole study material was used to define the breast size parameters for the female population in each country, and in a few cases also for the major ethnic subpopulations within a country.

The following parameters were analyzed and reported for each country and subpopulation:

- Mean breast volume (ml)
- Mean bra cup size ("A" to "F")
- Mean breast volume for the lowest volume quartile (ml)
- Mean breast volume for the highest volume quartile (ml)

Quality Analysis and Additional Data Collection

The study data received from the studies run in Europe, the U.S.A. and most Asian countries were generally of high quality.

The data from the studies conducted in emerging countries had more quality variations, because a part of the measurements had been filed primarily for other purposes than the defining of breast size.

In developed countries the measuring methods used were also more advanced than in most of the emerging countries.

In order to increase the data reliability all measurement data that had in any way a questionable quality was excluded from the final analysis.

As an additional control measure the research team arranged advanced breast size scanning with a topographical 3D scanner in 59 emerging countries.
These additional scanning results were used to recognize and exclude any national studies with low data quality.
The complementary scanning added to the study material the measurements of 11 682 women.

In Australia, Europe, New Zealand, the U.S.A and many Asian countries a similar scanning technology had already been used to collect the original national study results.

Large and Representative Material

The final analysis of the measurement data comprised nearly 342 000 individual breast size measurements from 108 different countries. Only data from women in the age group 28 to 30 years were included in the final analysis.

Most of the analyzed material had been collected as part of local or regional bra size studies run by clothing industry, cosmetic surgery providers and other local studies.

As an additional measure the research team arranged advanced 3D breast size scanning of 11 682 women in 59 emerging countries. The same scanning method had been used also in the original studies run in Australia, Europe, New Zealand, the U.S.A and many Asian countries.

Most of the women measured were volunteers who were willing to contribute to scientific anatomical research.

In order to ensure a representative sampling the women were not told that the study focuses on the anatomy of the breast, when they registered for the study. When the precise study subject was told a number of women were initially reluctant to participate. They were reminded of their opportunity to contribute to science and the full anonymity of the study data. When necessary they were also offered a limited financial compensation as an additional motivation to make them to allow the use of their measurement data recorded.

Finally, only 126 initially registered women refused to participate in the study. The low number of women who left the study did not have any impact on the statistical reliability of the study.

Inclusion Criteria

The target group of the analysis was non-pregnant, non-lactating women in the age group of 28 to 30 years with a normal health status.

Exclusion Criteria

Any measurements of currently pregnant or lactating women and women who had undergone any type of breast surgery were excluded from the analysis.

Women who were not lactating, but had been pregnant within the past 12 months, were excluded.

Women who had received any hormonal therapy other than contraceptives less than 30 days before the data collection were excluded.

Any uncertainly of the age or country of the birth were also seen as definitive exclusion criteria.

The menstrual cycle status of the studied women was deliberately ignored as the material was large enough to even out the impact of the menstrual status on the recorded breast volume.

Measuring tape

In all the studies included in the analyzed material a measuring with a traditional measuring tape was used as a complementary or in some cases even as a primary measuring method.

The band size and the bust measurement were defined. The indicative cup size was then defined in the traditional way by subtracting the band size from the bust measurement. All the measurements were performed with the woman standing in a relaxed vertical position with empty lungs (after exhalation). (Fig. 1, 2, 3)

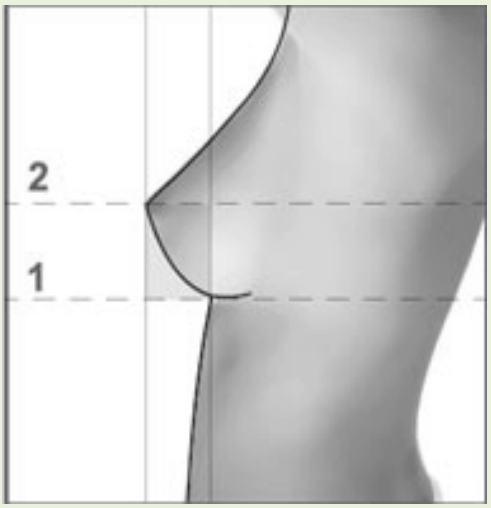

Figure 1: Measuring tape method. The cup size was defined by subtracting the band size (1) from the bust measurement (2). In this traditional method each inch of difference is said to represent a cup size step. The method is not reliable enough to define the factual breast size.

In the countries in which the measurement tape had been used as the only method of the national study, the data analyzing research team arranged additional 3D scanning to collect more accurate data in the country. The 3D data was then used as the primary source for the analysis.

In case the 3D data were not in line with the data from the national study, the data from the national study were totally excluded from the final analysis and the 3D scanning data were used as the basis for the statistical analysis.

In conclusion, the measuring tape method without a more accurate complementary method was not considered as a reliable enough method for defining the actual breast volume of women for the purposes of the present study analysis. The 3 D scanning results were found to be significantly more accurate and consistent.

In all the countries in which the original local study data were based on only the measuring tape method, the research team carried out additional 3 D scanning.

Figure 2: Measuring the band size with a measuring tape. All the measurements were recorded with the woman standing in a vertical position immediately following exhalation.

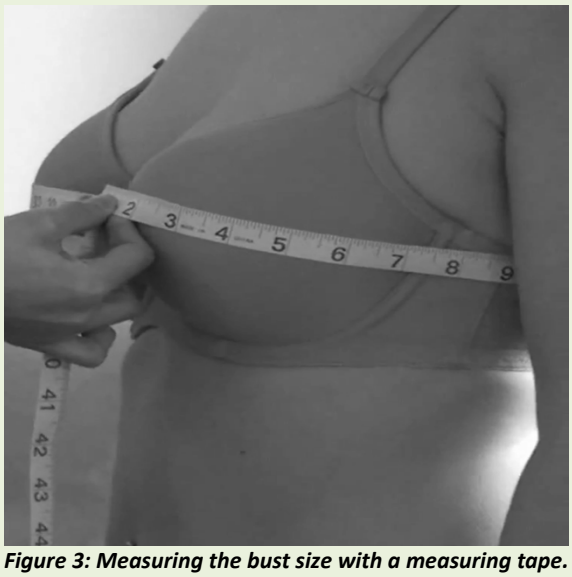

Figure 3: Measuring the bust size with a measuring tape.

Current Bra Size

In most of the local studies included in the material the bra band size and the bra cup size of the current bra of each woman were also recorded by asking her about her current bra label size and by checking her bra label.

In line with several previous research results our study concluded that a woman's self-perceived bra cup size was in most cases to be considered only as an indicative, and in some cases even imaginary, assumption, which had only a relatively low level of correlation with the factual volume of her breasts. The level of correlation varies significantly both between individual persons and countries.

The most important factor limiting the value of the current bra size as an indicator is the fact that many women do not wear a bra that fits their actual breast size. This applies particularly to low-income segment of the female populations and women in developing countries. In developed countries women use more frequently specialty store services and their bras are therefore more appropriately sized. However, even in developed countries, there is still a significant level of individual variation.

When a woman is wearing a too large bra, her breasts will sag on the lower part of the bra cups and her breast tissue does not fill out the bra cups properly. As a direct consequence of this her bra label does not reflect her factual breast volume i.e., her factual bra cup size. She also gets a subjective illusion of having a considerably larger bra cup size than what she actually has. (Fig. 4)

Figure 4: Many women wear a bra that does not fit properly. If the bra size is too large, breasts will sag and bra cups are not filled out completely. As a consequence of this, the women´s current bra labels do not reflect their factual breast volume i.e., factual bra cup size. In most cases like this the woman has a false illusion of having a considerably larger bra cup size than what she actually has.

It was observed that the number of error sources increased even more in a few small local studies in which the current bra size data was collected only verbally (face-to-face interview) or by using a questionnaire without checking the actual bra label in other words without the visual control of the current bra label.

When the questionnaire and interview data were compared with the data collected by using more accurate methods, i.e. 3 D scanning and measuring tape, it became evident that the data from interviews and questionnaires must be excluded from the final analysis due to inaccuracy. When women were asked about their current bra size, a significant part of them reported a larger bra cup size and a shorter bra band size than their current bra label actually indicated.

This type of incorrect reporting was not limited to women whose breasts were smaller than the average size. When the current bra labels were checked, it turned out that also women with medium-sized

breasts regularly reported a larger label size than what was actually indicated by their current bra label. In other words, there was an evident tendency among women to exaggerate the size of their breasts, when the visual control of the current bra label was not preannounced by the researchers. The finding was in line with the previous study observations regarding the fact that women are aware of the positive correlation between their breast size and their prestige in relation to other persons.

The present study confirmed that a woman´s current bra label size does not correlate reliably with her factual breast volume. Accordingly, the current bra cup size is of low value as an indicator for the factual bra cup size i.e., the breast volume of a woman.

In conclusion, there were several factors that limited the value of the current bra size as an indicator for the factual breast size of a woman:

- Many women wear inappropriate bra size. (Fig. 4)
- There is a considerable variation of the bra size standards between both the countries and the different bra manufactures. (Fig. 5)
- A large part of women with small breast size wear physical breast enhancers like silicon pads or breast forms inside their bra. (Fig. 6, 7)
- In materials collected verbally or by questionnaires both the women with smaller than average breasts and the women with medium-sized breasts tend to report a larger bra cup size and a shorter bra band size than what is actually indicated on their current bra label.

After an initial evaluation the data collected by recording the current bra label of women was considered to be clearly too inaccurate to be included in the analysis, so the current bra label data was left out from the final analysis.

Cup Sizes					
UK	USA	Europe	France	Italy	Australia
AA	Not available	AA	A	A	AA
A	Not available	A	B	B	A
B	Not available	B	C	C	B
C	A	C	D	D	C
D	B	D	DD	DD	D
DD	C	E	E	E	DD
E	D	F	F	F	E
F	DD				F
FF	DDD				FF
G	DDDD				G
GG	–				GG
H	E				H
J	F				J
JJ	G				JJ
K	H				K

Figure 5: There is a considerable variation of the bra cup sizing between the different countries and lingerie manufacturers. The indicative conversion chart above applies to bras with the 90 cm standard band size.

Figure 6: Women with small breasts wear often bra pads. This woman's cup size on the bra label is much larger than the actual size of her breasts.

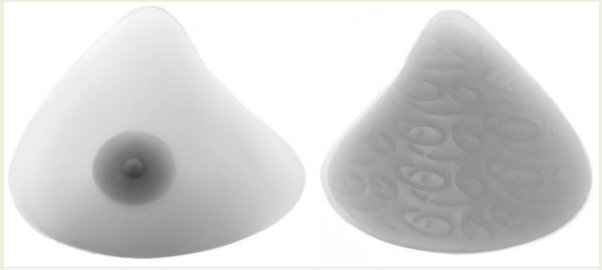

Figure 7: Women in many Asian and a few European countries wear quite commonly even silicone breast forms. Large breast forms create a considerable gap between the current bra size label and the factual breast volume of a woman.

3D Scanning

In the material studied automatized 3D breast scanning was used as the main method in Australia, Europe, New Zealand, the U.S.A. and most Asian Countries. The 3D scanning was also the method used for all the additional measurements obtained in the emerging countries with incomplete local study data.

Several types of 3 D scanners were used in the studies. All the scanners were of high medical quality and the equipment was calibrated by using standard samples.

The scanners used produced a three-dimensional photograph and a vector database of the target examined. All data were collected to a study database and a computer algorithm developed by UISS in cooperation with the research team was used to convert the digital breast images to numerical measurement data consisting of:

- Breast volume
- Length of the bust line
- Length of the waist line
- Location of the nipple
- Shape of the breast:
    - hemispherical (“round”)
    - pear-shaped
    - hanging
    - hanging with narrow tip
    - hanging with wide tip (“saggy”)
    - flat
- Bra Cup Size (based on the breast volume)
- Mass of the breast tissue

The modern automatized 3 D scanner technology allowed the researchers to measure effectively a large number of women. The Scanning of an individual took only 10 - 120 seconds, depending on the scanner model. The exact dimensions and a 3 D vector model of a woman´s breasts were either temporarily saved on a local laptop or sent directly to the research database used for the centralized analysis.

Clinic conditions were not found to be necessary for 3 D scanning. However, the measuring site must be in a quiet area, which is protected against unauthorized persons. Breasts of voluntary women were scanned successfully at educational institutions, company offices and in a few cases even in apartments. (Fig. 8, 9, 10, 11)

Figure 8: 3D Breast Scanning was used as the primary method in Australia, New Zealand, Europe, the U.S.A. and most Asian Countries. Automatized 3 D Breast Scanners produce highly reliable results in just a few seconds. The technology allowed the researchers to measure effectively a large number of women all over the world.
(Picture: Weatherford School of Clinical Imaging, Texas, USA)

The 3 D scanner equipment was calibrated by using water displacement (Archimedes method), MRI (magnetic resonance imaging) and casting as reference methods. These methods and the Grossman-Roudner device were not used as routine sampling methods of the study material as the 3 D Scanning was found to be the most practical method to measure the breast volume of a large number of women.

The 3 D scanning technology was found to be accurate, adequately fast and convenient for the women in the sample. As the sampling was based on voluntary participation the convenience of the 3 D scanning technology was essential. Most other methods were associated with a number of comfort limiting factors like health risks (mammography) and contact with foreign materials (casting, water displacement, Grossman-Roudner device).

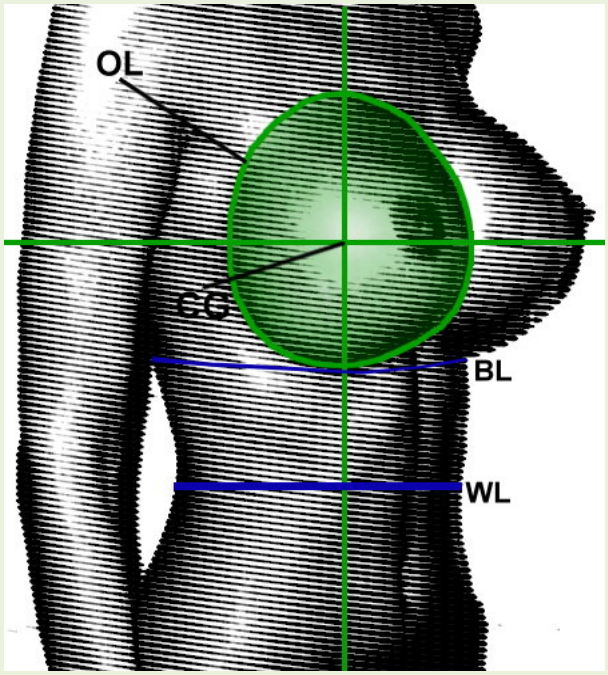

Figure 9: The analysis software makes an accurate 3D model of the breasts and defines reliably the values of the key parameters of the breast size and shape: Outer Line (OL), Center of Gravity (CG), Bust Line (BL), Waist Line (WL) and the exact form and volume of the breasts.
(Picture: Weatherford School of Clinical Imaging, Texas, USA)

Figure 10: Clinic conditions are not necessary for 3D Scanning. Breasts of voluntary women were scanned successfully at educational institutions, company offices and in a few cases even in apartments.
(Picture: Weatherford School of Clinical Imaging, Texas, USA)

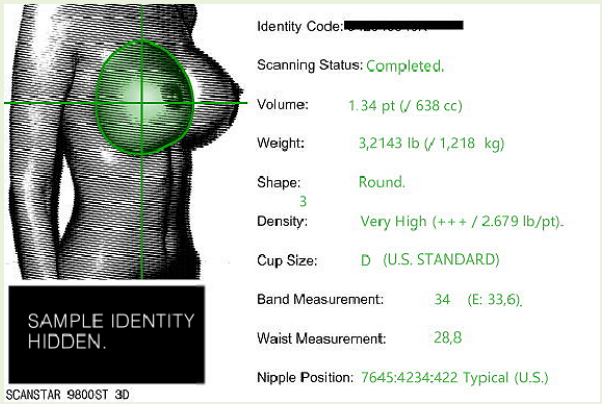

Figure 11: A screenshot example showing the key parameters calculated by the scanning software used in the study.
(Picture: Weatherford School of Clinical Imaging, Texas, USA)

Water Displacement

The Archimedes method involved submersion of the breasts into a water-filled container to calculate the amount of displaced water. The breast was placed in a container filled with water. The amount of displaced water was collected in another larger container. The volume of the displaced water was measured to reveal the breast volume.

Magnetic Resonance Imaging

To perform a study, the patient was positioned within a MRI scanner which formed a magnetic field around the breast area to be imaged. The scanned analyzed the signal emitted by excited hydrogen atoms in the body using energy from an oscillating magnetic field applied at the appropriate resonant frequency. The MRI scanner measured accurate breast volume by processing the magnetic field data using a well-established algorithm (BVA a606.2). (Fig. 12)

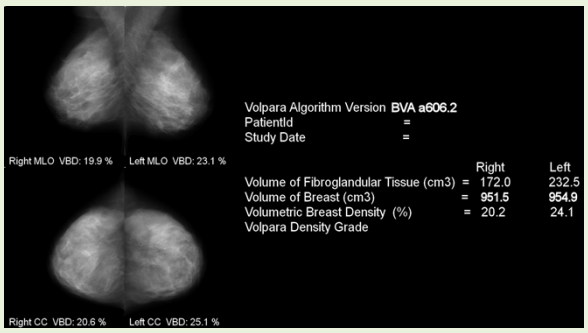

***Figure 12:** MRI was one of the reference methods used to calibrate the 3D Scanning Equipment.*

Casting

Synthetic gypsum (Policast II) was used to form a cast around the breast. A thin plastic film was used to protect the skin against a direct contact with the material. Breast volume was measured indirectly by filling the cast with water and measuring the volume of the displaced water.

Mammography

Mammographic volume measurement was not used as a primary method due to the health risks associated with the technology.

A very limited number of samples (1 280) included also mammograms taken to screen the breast health of the person included in the study.

Also the mammograms of the study material were evaluated concerning the size and density of the breast. The results of the mammogram evaluations concerning the size of the breasts were well in-line with the results collected by the 3 D scanning.

Due to the limited number of mammograms the findings concerning the breast tissue density results were not statistically significant.

Body weight and length

In most cases, the researchers measured the women's body weight and length (86%), but in some cases these basic data were recorded only on the basis of a questionnaire (14%).

Discussion

The smallest average breast volumes have women born in Africa and Asia, particularly in the East Asian countries. The Cup size "A" or even smaller was found to be the average cup size in many of the countries in these regions.

Caucasian women born in the U.S.A. have by far the largest breasts of all women. Their average bra cup size, when converted to the European measurement system, is substantially larger than "F", which is the largest standardized cup size in the EU. The relative cup size of the U.S. women could not be expressed as an exact cup size indicated by a letter symbol, because the cup size "F" is the largest cup size in the EU bra size standard. This is no obstacle for an accurate comparison of the mean breast size by country, as the absolute breast volumes measured are directly comparable between all the countries included in the study material.

Also women born in Canada have a substantially larger mean breast size than women born outside North America. The mean cup size of women of Canadian origin is "E" according to the EU bra size standard.

In a global comparison, relatively large breasts have also women born in Ireland, Poland, the United Kingdom, the Netherlands, Iceland Australia, New Zealand, Great Britain, Iceland, Netherlands, Norway, Colombia and Venezuela. The average breast size in these countries is "D".

In terms of absolute figures, the largest mean breast volumes have women born in the North American countries. The mean breast volume of Caucasian U.S. women was 1 668 ml and the mean breast volume of women born in Canada was 1 194 ml.

In Europe, relatively high mean breast volumes had women born in Ireland (992 ml), Poland (968 ml), the United Kingdom (879 ml), the Netherlands (801 ml) and Iceland (757 ml).

In Australia and New Zealand, the mean breast volumes were 652 ml and 640 ml, respectively.

The mean breast volumes of women born in African and Asian countries were generally substantially below 200 ml.

The population-specific mean breast volume in the material ranged from 111 ml (The Philippines) to 1 668 ml (Caucasian females born in the U.S.A.) (Fig. 13)

The present study material did not include reliable 3 D breast scanning results of women born in China, although it is one of the major developing markets. A previous study published by Chinese scientists carried out measurement of breast volume in 125 unmarried women. The mean breast volume of Chinese women was reported to be 325 ml (Qiao Q. et al, 1991). However, based on the findings of the present study, the factual mean breast volume of Chinese women can be expected to be 45 - 50 % lower, i.e. around 171 ml. The estimate is an extrapolation made based on the mean

difference in the breast volumes reported in similar local studies conducted using traditional methods in other Asian countries, and the factual mean breast volumes measured by reliable 3D scanning.

Figure 13: A typical U.S. woman with a large breast size. Caucasian women born in the U.S.A. have the largest breast size of all women. They have a mean breast volume of 1 668 ml.

Also the mean variation of the breast volume was found to vary between the countries. Among Caucasian U.S. women even the lowest breast volume quartile has a mean breast volume of 645 ml, which corresponds to the Bra Cup Size "D" according to the EU Size Standard. The highest quartile of the same population has a mean breast volume of 2 986 ml. In other words, the small breast volumes are extremely uncommon among the Caucasian females born in the U.S.A. in comparison to females of other geographical origin.

There is a significant variation of the breast size between different individuals in the all the countries included in the study. (Fig. 14)

Nevertheless, the mean breast volume is a reliable and relevant parameter used to describe the breast size variation between the countries.

Despite of the individual variation the clear majority of measured breast volumes of women born in a certain country were remarkably concentrated around the average volume of the country.

In other words, the standard deviation of the actual breast tissue volume of women born in a given country turned out to be considerably low.

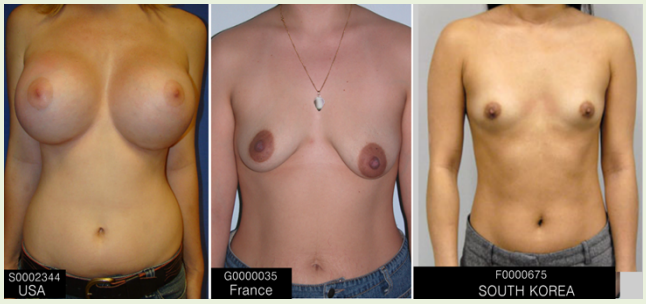

Figure 14: The size and shape of breasts vary individually. The analysis showed that there is also a strong correlation between the breast size of a woman and her country of birth. Women born in North America have typically a much larger breast volume than women born in any other country of the world.

Another key finding was made concerning the average shape of the breasts of women born in different countries. The advanced 3D scanning technology used in the present study allowed the research team to analyze accurately the three-dimensional shape of the women´s breasts. The shape of the breasts of each woman was allocated to one of the five shape categories based on the 3D measurement data of her breasts. The five breast shape categories used in the study were: "hemispherical" i.e., "round", "pear-shaped", "hanging", "hanging with narrow tip", "hanging with wide tip" i.e., "saggy" and "flat".

The statistical analysis of the study data shows that the shape of the female breast varies to some extent depending on the country of birth. Also in this respect the breasts of North American women differed very significantly from the rest of the study material. U.S. women have most commonly a hemispherical breast shape i.e. "round breasts", while the hemispherical breast shape is uncommon in the other countries. In most other countries the most common breast shape is "pear-shaped".

Due to the individual variation all the breasts shapes are present in every country, but their relative proposition varies. For example, the breast shape "flat" is almost non-existent among women born in the U.S.A, while most of the women in a number of Asian, as well as a few African, countries have breasts belonging to this shape category.

The difference in the breast shape between the U.S. women and the women in the other Countries increases linearly with the breast volume. In other words, the difference is most remarkable among women belonging to the highest volume quartiles of the female population.

In all the countries, with the exception of the U.S.A, the most common breast shape in the highest volume quartile is "hanging" or "hanging with wide tip i.e. saggy". In contrast, even the U.S. women belonging to the highest volume quartile had most commonly hemispherical i.e., "round" breasts.

The variation of the average breast shape from one country to another must be considered as a very significant error source of any previous breast volume studies that have been based on conventional study methods without 3D scanning technology.

Most of the previous breast size studies have been based on traditional methods like recording of the current bra size and measuring with a measuring tape. The impact of the breast shape variation has not been observed due to the method error associated with the variation of the average breast shape between women in different countries.

In the most countries of the world the average woman has "pear-shaped" breasts. From the practical point of view this means that the breasts rest on the bottom of the bra cup and the breast tissue fills mainly the lower part of the cup. As a direct consequence of this the aperture area and the bra top do not contain breast tissue to any significant extent.

In contrast, a typical U.S. woman has hemisphere-shaped i.e., "round" breasts that fill also the upper part of the bra cup. Consequently, also the aperture area and the bra top are filled with breast tissue.

The difference in the average shape of the breasts have a very significant impact on how reliably the traditional bra measuring methods, like actual bra cup size and measuring tape, can be expected to describe the actual breast tissue volume.

The 3D scanning results of the comprehensive material analyzed within the scope of present study show that the breast shape variation is an important error source limiting the value of the traditional bra measuring methods as an indicator of breast volume. On the average, a U.S. born Caucasian woman has as much as 38 % higher actual breast tissue volume than the average non-U.S. woman wearing a bra of identical shape and size. (Fig. 15, 16)

The finding is very significant as the 3D scanning technology eliminates all the major error sources, e.g., variation of breast shape, variation of bra labelling, inappropriate current bra size, false verbal reporting of current bra size and use of breast enhancers (bra pads and forms).

Figure 15: U.S. women have commonly a round hemispherical breast shape, so their breasts fill also the upper part of the bra cup, while other women typically have more pear-shaped breasts, which fill only the lower part of the bra cup. 3 D scanning generates accurate breast volume data independent of the breast shape.

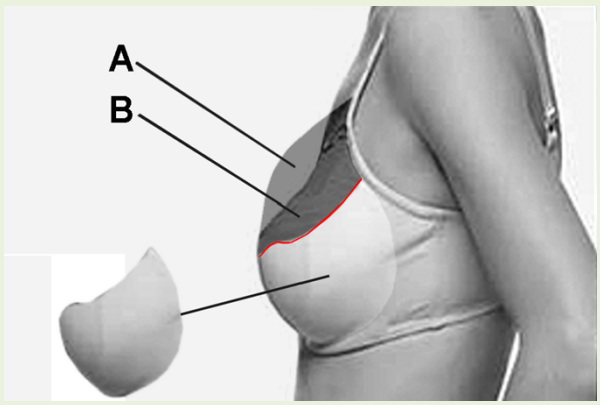

Figure 16: In contrast to U.S. women, women in other countries have typically more pear-shaped breasts, which rest on the bottom of the bra cup (above). Consequently, their breast tissue fills only the lower part of the cup (white area; upper breast line is marked with red). The darkened volume (B) inside the bra does not contain breast tissue. The hemisphere-shaped breasts of U.S. women fill both the volumes A (aperture area) and B (bra top). On average, A U.S. born Caucasian woman has 38 % more breast tissue volume than a non-U.S. woman wearing a bra of identical shape and size. ((volume A + volume B) / volume of the white area * 100 = 38).

The statistical analysis revealed also that the average position of nipple of North American women differs significantly from the average nipple position of women born in the other parts of the world. The nipple of the average U.S. woman is pointing up with an angle of 24 degrees to the horizontal and it is placed 3.84 cm above the center of gravity of her breasts. Among women in the other countries the nipple is on the average placed 2.42 cm below the center of gravity and it makes an angle of -14 degrees to the horizontal.

The differences in the nipple position are probably at least to a certain degree linked to the differences in the average form of the breasts in the countries.

In any case, the difference in the relative position of the nipple needs to be taken to account in the design of lingerie products. The fact that the nipple of a typical U.S. woman points upwards and is located on average 6.26 cm higher than the nipple of the average woman of other geographic origin, is of importance for the customer experience in the underwear business.

As an example, a bra optimized for the global market may have seams or decorative details located in the nipple area of the average U.S. woman and cause irritation of the skin in the nipple area. This kind of suboptimal product planning is known to have strong negative impact on the customer satisfaction, so the finding concerning the differences in the nipple position needs to be taken seriously within the lingerie industry.

In general, most of the study results were in line with the results of the previous more limited breast size studies and the common stereotypic expectations of the majority of the population.

However, although it was already previously well known that U.S. born women have a relatively large breast size, the magnitude of the factual difference in the breast size between U.S. born Caucasian women and other women was larger than most of the research team members had expected.

Most probably the factual magnitude of the size difference has not been detected earlier due to the several reasons:

- Comparable 3 D scanning has not been used in previous international studies. Using the 3 D measuring the factual breast volume can be measured in an accurate manner.

- U.S. born women have commonly a very round hemispherical breast shape that fills the also the upper part of a bra cup, while other women typically have a more pear-shaped chest, which fills only the lower part of the bra cup. Even when a U.S. woman wears a bra with the same cup size as a woman born in another country, the U.S. woman has typically a significantly larger breast volume than the other woman. This kind of breast shape variation between different female populations and individuals is one of the major reasons why the traditional measuring methods (measurement tape and recording of the bra size currently in use) are not as such reliable enough in defining the factual breast volume of women.

- The commercially used bra cup size standards are very different in the U.S. than in most other countries. For example, in Europe and Asia the lingerie manufacturers commonly label small bras with too large cup size indication in order to make the customers to feel more comfortable with their breast size.

Correlation between body weight and breast size varies from country to country

The analysis of the results also showed that the correlation between a woman's body weight and the size of her breasts is quite different from one country to another.

A typical woman born in the U.S.A. or Canada has a very large breast volume regardless of her body weight. In many other countries a large cup size is closely associated with a higher than average body weight. This association was particularly evident in the United Kingdom and Spain.

In the U.S.A. and Canada also sporty and fit women have very large breasts compared to women born in the other countries.

52 % of the U.S. born Caucasian women with BMI 21 – 24 had the factual breast cup size “F” or larger (EU standard). Among the women born in the other countries the largest breast size was very uncommon in this BMI category (<4%). (Fig. 17)

$$\mathrm{BMI} = \frac{\mathrm{mass(kg)}}{(\mathrm{height(m)})^2}$$

$$= \frac{\mathrm{mass(lb)}}{(\mathrm{height(in)})^2} \times 703^{\dagger}$$

Figure 17: body mass index (BMI) is a measure for human body shape based on an individual's weight and height.

Conclusions

The study analysis showed that there is a considerable variation in the breast volume, i.e. "bra cup size" of women depending on their country of birth.

Women born in the U.S.A have by far larger breasts than women in any other country, while women born in Africa and Asia, particularly in the East Asian countries, have the smallest breast volumes.

In general, the differences in the breast size are expected to decrease due to the international migration of people. Currently the differences in the breast size between the countries are still very prominent. The material included the present analysis was collected during the years 2007 - 2012.

As international trade and traveling are rapidly increasing, it is necessary to create globally comparable standards for clothing industry. The study analysis showed that in particular the lingerie and sportswear industries need internationally established standards as both the breast size, the shape of the breasts and the cup size labelling vary remarkably from country to country.

Based on the present study results the researcher group concluded that the recent update of the International Breast Shape Standard (IBSS) was of outmost importance for a number of commercial reasons and psycho-social considerations related to the smooth interaction between people of different geographical origin.

First of all, the international trade of bras, swimsuits, sportswear and other garment has become very common as web based e-commerce and traveling have increased. This has created practical problems for the garment industry, retailers and female consumers all over the world.

The latest update of the IBSS standard can be considered as a major improvement of international bra size standardization, not least in North American women's point of view, as the most common U.S. Breast type is now included in the IBSS standard.

U.S. women and lingerie shops have previously regularly received too small bras from the international lingerie producers not familiar with the U.S. conditions.

On the other hand, many foreign women have been embarrassed by the too large size of the bras they have ordered from the U.S.A. referring to the European, British or Asian cup sizes. For example, the U.S. cup Size "C" typically matches the European cup size "E", so the consumers are confused without proper reference standards.

A more aligned size labelling is clearly needed. However, the global clothing industry is not able to overcome the challenge of geographical variation only by adapting the size labelling as also quality issues have been frequently reported. For example, the structure of the bras imported to the U.S.A. has not always been robust enough to tolerate the weight of the U.S. type of breasts.

The findings of the present study confirm the need of geographically based adaptation of the products. A typical Caucasian woman born in the U.S.A. has a breast volume of 1 668 ml and the highest quartile of Caucasian U.S. women has a mean breast volume as high as 2 986 ml. In the Philippines, the mean breast volume is only 111 ml and even the highest quartile of Filipino women has a mean breast volume of only 179 ml.

In other words, 25% of Caucasian U.S. women have a total mean breast mass of about 5,7 kg, while a Filipino woman belonging to the bustiest quartile in her country, only has a total breast mass of about 0,3 kg. The kinetic forces generated by the movement of a U.S. women´s breasts are nearly 20 times higher than the forces generated by the breasts of a Filipino women.

In practical terms this means for that when an average U.S. woman of the highest volume quartile is running (8 m/s) and stops within a distance of 0,5 m, her breasts generate a kinetic force of 370 N, which equals to the gravitation force of a mass of nearly 38 kg. In the same situation the breasts of a Filipino woman, who belongs to the highest volume quartile in her country, generate a kinetic force of not more than 19 N, which equals to the gravitation force of a mass of less than 2 kg.

The absolute difference in the forces generated by the breasts of U.S. women and the breasts of Filipino women is even larger in situations associated with higher acceleration than the example.

Taking to account the large differences in the breast mass and kinetic forces it is obvious that the expectations on the structural stability of a bra product intended for the U.S. market are totally different than for the products intended for the Philippine market or other Asian markets.

According to previous studies the breasts of a typical U.S. woman have very durable and rigid suspensory ligaments which position her breasts firmly high upon the chest wall and also give the breasts quite a rigid hemispherical shape. However, although U.S. women have relatively firm breasts, it is obvious that a bra of a U.S. woman has to stand up structural stress of a totally different magnitude than a bra of a woman of Filipino or other Asian origin.

It is quite obvious that a bra intended for the U.S. market must be an advanced supportive product with no compromise on comfort and style. It must be made of durable high quality materials using the most advanced technologies to maximize the structural stability of the bra. (Fig. 18)

On the hand, a bra intended for the Asian markets can be made of inexpensive materials with using very light and simple structures. Virtually a bra for the Asian markets is to be considered more like an esthetic product, while a bra made for the U.S. market must be an advanced supportive product in order to meet the customer expectations. It is obvious that a lingerie product optimized for Asian markets is not suitable for the U.S. market. (Fig. 19)

Market specific product adaptation is absolutely necessary. U.S. customers have understandably quite different expectations concerning the material quality, durability, and supportive structures than Asian customers.

The need of market-specific product adaption is most apparent concerning sports bras. A typical U.S. woman needs a stabile bra that is able to withstand high kinetic forces without damage to the fabrics or supportive structures. In order to meet her needs a bra needs to have strong stabilizing structures made of advanced durable materials, but also comfortable cup materials like microfiber, cotton or polyester-polyester copolymer (Lyctra, Spandex). (Fig. 20)

In contrast, a typical Asian woman expects even her sports bra to be padded and affordable. Her needs can be met even by inexpensive bras with a simple sheer fabric construction made of materials like viscose or rayon. (Fig. 19, 20)

The geographical differences in the label sizing and product quality have a major impact on both profitability and consumer satisfaction. Even legal complications caused by inadequate product quality and inconsistent sizing are quite frequently reported (consumer protection legislation).

There is all reason to expect that the increasing use of the updated IBSS standard will make the international trade of women´s clothing more fluent and easier for all stakeholders than before.

Figure 18: In order to meet the customer expectations a bra made for the U.S. market must be an advanced supportive product with no compromise on comfort or style. It needs to be made of durable high quality materials using the most advanced technologies to maximize the structural stability of the bra.

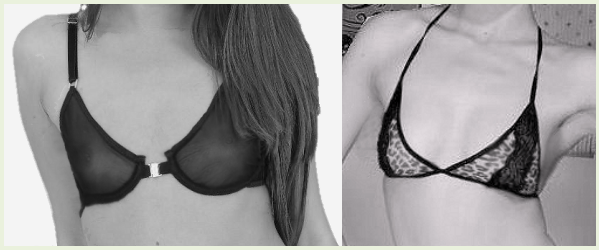

Figure 19: Bras intended for the Asian markets can be made of inexpensive materials with using very light and simple structures. Virtually, a bra made for the Asian markets is to be considered mainly as an esthetic product.

Figure 20: The need of market-specific product adaption is most apparent concerning sports bras. A typical U.S. woman needs a stabile bra that is able to withstand high kinetic forces without damage to the fabrics or supportive structures (left). In contrast, a typical Asian woman expects even her sports bra to be padded and affordable (right).

Secondly, the increasing awareness of breast size differences between countries will help to reduce the embarrassing situations experienced by people traveling, studying or shopping abroad.

The knowledge of the psycho-social aspects of the breast volume variation has increased considerably in the last decade. Research conducted at the Victoria University of Wellington showed that breasts are often the first thing men look at, and for a longer time than other body parts. This may be due to the fact that larger breasts indicate higher levels of estrogen and are therefore a sign of greater fertility. Most people regard female breasts to be highly erotic. It is well known that large breasts cause strong sexual desire in heterosexual men.

A number of recent psychological studies have concluded that breast size is an important factor not only for interaction between women and men, but also between female individuals.

A woman´s breast size correlates positively with her sexual attractiveness and social prestige. It is well known that any unforeseen variations of the interpersonal prestige factors impede the interaction between people and cause stress for those individuals whose prestige factors become relatively inferior due to the unexpected change.

Several leading behavioral psychologists recommend that young people, who travel abroad for the first time, should have access to appropriate information on country-specific differences in women´s breast size.

It has been shown that young women who come to the United States as exchange students have a very high incidence of mental problems related to their body image and self-esteem.

In-depth interviews of the affected exchange students have revealed that one of the key reasons for the problems is that they feel anxiety, when they realize that their breasts are so substantially smaller in size than the breasts of U.S females. Such an unexpected observation is especially difficult for young females to deal with, because their own sexuality and body image may still be quite fragile. They are already well aware of the breasts role as an important secondary sexual characteristic of females, so they know that women with large breasts are seen as being more desirable by the opposite sex.

A number of previous studies have concluded that differences in breast size have a significant mental impact in adolescent girls, affecting self-esteem, emotional well-being and social functioning. It is therefore quite natural they need to go through a mental adaptation phase to figure out how the anatomical difference, that they suddenly face, impacts their social status and interaction with other people, in specific the opposite sex. The unexpected observation of the difference in the breast size has often a remarkable negative impact on their self-esteem.

Apparently most of the affected foreign students arriving in the U.S.A. are totally unprepared to face any anatomical differences, so they have no possibility to any mental adaption before they arrive for their exchange.

The young non-U.S. females arriving first time in the U.S.A. are mentioned as the most unambiguous example of psychosocial implications the breast size differences can induce, because they have the highest risk of developing situational low self-esteem. However, the breast size differences between the countries can be expected to be associated with a number of less obvious effects on the everyday interaction between both female and male individuals of different geographical origin all over the world.

The incidence of self-esteem related problems among the young first time travelers could probably be reduced by informing them properly about the geographically based differences in the breast size, before they leave their home country.

Gradually increasing awareness and the slowly improving international size standardization can be expected to facilitate a smoother interaction between individuals of different geographical origin.

Figure 21: As breast size is an important prestige factor in nearly all cultures, several leading behavioral psychologists recommend that young people, who travel abroad for the first time, should have access to appropriate information on country-specific differences in women´s breast size. Increasing awareness can be expected to contribute to a smoother interaction between individuals of different geographical origin.

In summary, the present study analysis confirmed that there is a substantial variation of the mean breast volume of women born in different countries.

The statistically reliable country-specific breast volume data generated is expected to be of value for the increased international trade as well as for the regional product portfolio adaptation and marketing material optimization within the clothing and entertainment industries. Systematically collected and analyzed breast volume data can contribute to increasing the profitability of the manufacturing and retail sector through an improved geographical adaptation of several sub processes in research and development, product design, sales, marketing and logistics.

The geographical adaptation of industrial processes has not only a positive impact on the profitability, but also an indirect positive impact in form of improved customer experience as consumer's market specific expectations can be met more accurately.

The results of the present study can also be used to increase the general awareness of the geographically based variation of women´s breast size. Increasing awareness can be expected to contribute to a smoother interaction between individuals of different geographical origin. (Fig. 21)

Acknowledgements

The Members of the Researcher Group thank all persons, institutions and companies that have contributed in this study analysis. In special we thank the local researcher colleagues who collected and shared the results in all the national sub studies.

Annex I

Average Bra Cup Size and Mean Breast Volume of 28 – 30 years old Women by Country of Birth

SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	RESULTS	RESULTS	RESULTS	RESULTS
Women born in	Type of local study	total n =	Method (Local Study)	excluded	additional	analyzed	Mean Cup Size	Mean Vol.	Lowest 25%	Highest 25%
				(n)	(n)	(n)	(EU Size Stand.)	(ml)	Mean Vol.(ml)	Mean Vol.(ml)
Angola	In connection to the health controls or vaccination	3 164	Measuring tape	633	225	2 756	**A**	**179**	54	304
Argentina	Commercial screening by a local company	9 231	Visual examination, measuring tape, 3 D Scanning	1 385		7 846	**B**	**315**	95	536
Armenia	Commercial screening by a local company	1 141	Measuring tape	534	122	729	**B**	**230**	69	391
Australia	Commercial screening by an international compan	7 323	Visual examination, measuring tape, 3 D Scanning	1 098		6 225	**D**	**652**	196	1108
Austria	Commercial screening by an international compan	1 473	Visual examination, measuring tape, 3 D Scanning	0		1 473	**B**	**389**	117	661
Azerbaijan	Commercial screening by a local company	2 234	Measuring tape	933	264	1 565	**B**	**254**	76	432
Bangladesh	In connection to the health controls or vaccination	4 766	Measuring tape	1 063	406	4 109	**<A**	**116**	<40	189
Barbados	Commercial screening by a local company	1 662	Visual examination, measuring tape, 3 D Scanning	249		1 412	**B**	**219**	66	372
Belarus	Commercial screening by a local company	3 670	Measuring tape	601	186	3 255	**B**	**360**	108	612
Belgium	Commercial screening by an international compan	2 212	Visual examination, measuring tape, 3 D Scanning	123		2 089	**B**	**268**	80	456
Benin	In connection to the health controls or vaccination	856	Measuring tape	228	125	753	**A**	**158**	47	269
Bolivia	Commercial screening by a local company	2 185	Visual examination, measuring tape, 3 D Scanning	328		1 857	**B**	**354**	106	602
Bosnia & Herzegovina	Commercial screening by an international compan	962	Visual examination, measuring tape, 3 D Scanning	144		818	**B**	**352**	106	598
Botswana	In connection to the health controls or vaccination	1 064	Measuring tape	254	295	1 105	**A**	**175**	53	298
Brazil	Commercial screening by a local company	7 787	Visual examination, measuring tape, 3 D Scanning	1 268		6 519	**B**	**357**	107	607
Bulgaria	Commercial screening by a local company	3 284	Visual examination, measuring tape, 3 D Scanning	493		2 791	**C**	**473**	142	804
Burkina Faso	In connection to the health controls or vaccination	1 347	Measuring tape	398	125	1 074	**A**	**139**	42	236
Burundi	In connection to the health controls or vaccination	1 875	Measuring tape	486	89	1 478	**A**	**143**	43	243
Cambodia	In connection to the health controls or vaccination	1 327	Measuring tape	432	64	959	**A**	**179**	54	304
Cameroon	In connection to the health controls or vaccination	853	Measuring tape	345	85	593	**A**	**152**	46	258
Canada	Commercial screening by a local company	8 844	Visual examination, measuring tape, 3 D Scanning	1 327		7 517	**E**	**1 194**	453	2110
Central African Republic	In connection to the health controls or vaccination	2 020	Measuring tape	496	192	1 716	**A**	**189**	57	321
Chad	In connection to the health controls or vaccination	4 414	Measuring tape	1 044	298	3 668	**A**	**153**	46	260
Chile	Commercial screening by an international compan	6 282	Visual examination, measuring tape, 3 D Scanning	942		5 340	**B**	**274**	82	466
Colombia	Commercial screening by an international compan	4 553	Measuring tape	683	67	3 937	**D**	**781**	234	1328
Congo	In connection to the health controls or vaccination	5 265	Measuring tape	790	142	4 617	**A**	**189**	57	321
Costa Rica	Commercial screening by a local company	1 944	Visual examination, measuring tape, 3 D Scanning	292		1 653	**B**	**299**	90	508
Cote d'Ivoire	In connection to the health controls or vaccination	1 042	Measuring tape	200	64	906	**A**	**187**	56	318
Croatia	Commercial screening by an international compan	980	Visual examination, measuring tape, 3 D Scanning	147		833	**B**	**374**	112	636
Cyprus	Commercial screening by an international compan	952	Visual examination, measuring tape, 3 D Scanning	143		809	**B**	**376**	113	639
Czech Republic	Commercial screening by an international compan	1 461	Visual examination, measuring tape, 3 D Scanning	0		1 461	**B**	**379**	114	644
Denmark	Commercial screening by an international compan	2 088	Visual examination, measuring tape, 3 D Scanning	313		1 775	**C**	**574**	172	976
Dominican Republic	Commercial screening by an international compan	1 195	Measuring tape	179	94	1 110	**B**	**358**	107	609
Ecuador	Commercial screening by an international compan	1 297	Visual examination, measuring tape, 3 D Scanning	195		1 102	**B**	**353**	106	600
El Salvador	Commercial screening by a local company	1 617	Visual examination, measuring tape, 3 D Scanning	243		1 374	**B**	**355**	107	604
Equatorial Guinea	In connection to the health controls or vaccination	999	Measuring tape	253	75	821	**A**	**172**	52	292
Eritrea	In connection to the health controls or vaccination	1 245	Measuring tape	260	84	1 069	**A**	**153**	46	260
Estonia	In connection to the health controls or vaccination	803	Visual examination, measuring tape, 3 D Scanning	120		683	**B**	**386**	116	656
Ethiopia	In connection to the health controls or vaccination	3 043	Measuring tape	645	210	2 608	**A**	**177**	53	301
Finland	Commercial screening by an international compan	957	Visual examination, measuring tape, 3 D Scanning	0		957	**C**	**614**	184	1044
France	Commercial screening	3 813	Visual examination, measuring tape, 3 D Scanning	298		3 515	**A**	**154**	46	262
Germany	Commercial screening by an international compan	3 055	Visual examination, measuring tape, 3 D Scanning	0		3 055	**D**	**620**	186	1054
Ghana	In connection to the health controls or vaccination	4 543	Measuring tape	682	445	4 307	**A**	**182**	55	309
Greece	Commercial screening by a local company	1 815	Visual examination, measuring tape, 3 D Scanning	523		1 292	**B**	**385**	116	655
Guinea	In connection to the health controls or vaccination	1 595	Measuring tape	354	76	1 317	**A**	**132**	40	224
Guyana	In connection to the health controls or vaccination	1 595	Measuring tape	322	138	1 411	**B**	**323**	97	549
Hungary	Commercial screening by an international compan	2 096	Measuring tape	0	336	2 432	**B**	**388**	116	660
Iceland		0	No national study	0	80	80	**D**	**757**	227	1287
India	In connection to the health controls or vaccination	12 566	Measuring tape	1 885	231	10 912	**B**	**329**	99	559
Indonesia	Commercial screening by a local company	7 953	Measuring tape	1 193	253	7 013	**<A**	**127**	<40	216
Ireland	Commercial screening by an international compan	3 328	Visual examination, measuring tape, 3 D Scanning	0		3 328	**D**	**992**	328	1736
Italy	Commercial screening by a local company	9 453	Visual examination, measuring tape, 3 D Scanning	2 025		7 428	**A**	**189**	57	321
Japan	Commercial screening by an international compan	11 475	Visual examination, measuring tape, 3 D Scanning	0		11 475	**A**	**179**	54	304
Kenya	In connection to the health controls or vaccination	5 119	Measuring tape	768	363	4 714	**A**	**180**	54	306
Korea South	Commercial screening by an international compan	1 369	Visual examination, measuring tape, 3 D Scanning	0		1 369	**A**	**146**	44	248
Kosovo	In connection to the health controls or vaccination	1 706	Visual examination, measuring tape, 3 D Scanning	256		1 450	**B**	**364**	109	619
Laos	Commercial screening by a local company	1 934	Visual examination, measuring tape, 3 D Scanning	290		1 644	**<A**	**123**	<40	204
Latvia	Commercial screening by a local company	1 545	Visual examination, measuring tape, 3 D Scanning	246		1 299	**B**	**376**	113	639
Lithuania	Commercial screening by a local company	1 815	Measuring tape	272	108	1 651	**B**	**383**	115	651
Malaysia	Commercial screening by an international compan	2 532	Visual examination, measuring tape, 3 D Scanning	380		2 152	**<A**	**113**	<40	182
Mali	In connection to the health controls or vaccination	5 307	Measuring tape	796	166	4 677	**A**	**155**	47	264
Mexico	Commercial screening by an international compan	9 285	Measuring tape	2 393	295	7 187	**B**	**299**	90	508
Montenegro	Commercial screening by an international compan	1 188	Visual examination, measuring tape, 3 D Scanning	178		1 010	**B**	**354**	106	602
Mozambique	In connection to the health controls or vaccination	2 063	Measuring tape	643	254	1 674	**<A**	**125**	<40	213
Namibia	In connection to the health controls or vaccination	4 439	Measuring tape	876	371	3 934	**B**	**297**	89	505
New Zealand	Commercial screening by an international compan	1 624	Visual examination, measuring tape, 3 D Scanning	0		1 624	**D**	**640**	192	1088
Niger	Commercial screening	2 497	Measuring tape	456	102	2 143	**A**	**163**	49	277
Nigeria	In connection to the health controls or vaccination	3 936	Measuring tape	803	295	3 428	**A**	**165**	50	281
Norway	Commercial screening by an international compan	1 595	Visual examination, measuring tape, 3 D Scanning	0		1 595	**D**	**638**	191	1085
Papua New Guinea	Commercial screening by an international compan	1 319	Visual examination, measuring tape, 3 D Scanning	198		1 121	**<A**	**128**	<40	218
Paraguay	Commercial screening by an international compan	3 274	Measuring tape	491	155	2 938	**B**	**372**	112	632
Peru	Commercial screening by an international compan	5 015	Visual examination, measuring tape, 3 D Scanning	752		4 262	**B**	**372**	112	632
Poland	Commercial screening by an international compan	2 532	Visual examination, measuring tape	0	95	2 627	**D**	**968**	290	1746
Portugal	Commercial screening by an international compan	2 579	Visual examination, measuring tape, 3 D Scanning	387		2 192	**B**	**384**	115	653
Romania	In connection to the health controls or vaccination	2 265	Visual examination, measuring tape, 3 D Scanning	340		1 925	**B**	**370**	111	629
Russia	Commercial screening by a local company	9 345	Visual examination, measuring tape	1 845	1102	8 602	**B**	**359**	108	610
Rwanda	In connection to the health controls or vaccination	1 848	Measuring tape	478	98	1 468	**A**	**169**	51	287
Samoa	Commercial screening by an international compan	625	Measuring tape	94	83	614	**<A**	**117**	<40	191
Senegal	In connection to the health controls or vaccination	1 423	Measuring tape	423	75	1 075	**A**	**172**	52	292
Serbia	Commercial screening by a local company	1 468	Visual examination, measuring tape, 3 D Scanning	220		1 248	**B**	**266**	80	452
Singapore	Commercial screening by an international compan	1 976	Measuring tape	277	175	1 874	**<A**	**126**	<40	214
Slovakia	Commercial screening by an international compan	1 711	Visual examination, measuring tape	257		1 455	**B**	**273**	82	464
Slovenia	Commercial screening by an international compan	1 163	Visual examination, measuring tape	174	112	1 101	**B**	**270**	81	459
Solomon Islands	Commercial screening by an international compan	866	Measuring tape	130	90	826	**<A**	**119**	<40	195
South Africa	Commercial screening by an international compan	9 027	Visual examination, measuring tape	1 354	235	7 908	**B**	**386**	116	656
South Sudan	In connection to the health controls or vaccination	2 707	Measuring tape	534	276	2 449	**A**	**186**	56	316

SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	SOURCE	RESULTS	RESULTS	RESULTS	RESULTS
Women born in	Type of local study	total n =	Method (Local Study)	excluded	additional	analyzed	Mean Cup Size	Mean Vol.	Lowest 25%	Highest 25%
				(n)	(n)	(n)	(EU Size Stand.)	(ml)	Mean Vol.(ml)	Mean Vol.(ml)
Spain	Commercial screening by a local company	9 324	Visual examination, measuring tape, 3 D Scanning	1 399		7 925	**C**	**489**	147	831
Sri Lanka	Commercial screening by a local company	1 096	Measuring tape	164	98	1 030	**<A**	**126**	<40	214
Sudan	In connection to the health controls or vaccination	3 075	Measuring tape	743	142	2 474	**A**	**187**	56	318
Sweden	Commercial screening by an international compan	957	Visual examination, measuring tape, 3 D Scanning	0		957	**C**	**599**	180	1018
Switzerland	Commercial screening by an international compan	1 042	Visual examination, measuring tape, 3 D Scanning	156		885	**B**	**359**	108	610
Taiwan	Commercial screening by an international compan	4 663	Visual examination, measuring tape, 3 D Scanning	699		3 964	**<A**	**119**	<40	195
Tanzania	In connection to the health controls or vaccination	8 234	Measuring tape	1 235	240	7 239	**A**	**176**	53	299
Thailand	Commercial screening by an international compan	14 366	Measuring tape	3 005	488	11 849	**<A**	**122**	<40	202
The Netherlands	Commercial screening by an international compan	3 596	Visual examination, measuring tape, 3 D Scanning	539		3 057	**D**	**801**	240	1362
The Philippines	Commercial screening by an international compan	4 648	Measuring tape	697	101	4 051	**<A**	**111**	<40	179
Togo	In connection to the health controls or vaccination	1 959	Measuring tape	386	85	1 658	**A**	**159**	48	270
Trinidad & Tobago	In connection to the health controls or vaccination	4 538	Measuring tape	745	306	4 099	**B**	**235**	71	400
Turkey	Commercial screening by a local company	2 201	Visual examination, measuring tape, 3 D Scanning	330		1 871	**D**	**668**	200	1136
Ukraine	Commercial screening by a local company	2 120	Measuring tape	379	269	2 010	**B**	**389**	117	661
United Kingdom	Commercial screening by an international compan	8 120	Visual examination, measuring tape, 3 D Scanning	50		8 070	**D**	**879**	264	1494
United States of America (Caucasian)	Commercial screening by a local company	9 961	Visual examination, measuring tape, 3 D Scanning	269		9 692	**>F**	**1 668**	645	2986
United States of America (Non-Caucasian)	Commercial screening by a local company	4 775	Visual examination, measuring tape, 3 D Scanning	214		4 561	**E**	**1 089**	327	1851
Uruguay	Commercial screening by an international compan	6 902	Measuring tape	1 135	302	6 069	**B**	**371**	111	631
Venezuela	Commercial screening by a local company	4 323	Measuring tape	1 798	68	2 593	**D**	**752**	249	988
Vietnam	Commercial screening by a local company	8 232	Visual examination, measuring tape, 3 D Scanning	1 235		6 997	**<A**	**121**	<40	200
Zambia	In connection to the health controls or vaccination	9 630	Measuring tape	1 444	362	8 547	**A**	**162**	49	275
Zimbabwe	In connection to the health controls or vaccination	6 894	Measuring tape	1 034	254	6 114	**<A**	**129**	<40	219
Total number of women (n)		**390 458**		**60 516**	**11 682**	**341 878**				

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